APPLICATION TO RENEW A PERMIT TO OPERATE A CLASS I LANDFILL

Prepared for:

EMERY COUNTY LANDFILL
Castle Dale, Utah

Prepared by

IGES, INC.
4153 Commerce Drive
Salt Lake City, Utah 84107

September 26, 2005

ANNOTATED TABLE OF CONTENTS

Part	Title
	Introduction Includes summary of permit with technical and operational issues highlighted
I.	**General Data** Includes State of Utah Solid Waste Permit Application forms
II.	**General Report** Includes information required by Utah Administrative Rule R315-301 through R315-310
III.	**Technical and Engineering Report** Includes information required by Utah Administrative Rule R315-301 through R315-310

INTRODUCTION

This document presents an application to renew a permit to operate solid waste disposal facilities at the Emery County Landfill, which is owned and operated by Emery County. The Emery County Landfill is currently operated under permit number 9427 issued by the Utah Solid and Hazardous Waste Control Board. This permit became effective on June 1, 1998 and expires at midnight on May 31, 2003.

In the four and one half years that have passed since the current permit was issued to the Emery County Landfill, only minor changes have taken place, those changes are reflected in this permit application.

This permit application contains conceptual level engineering sufficient for permitting purposes only. This permit application does not represent a lateral expansion to the currently permitted landfill cells. It does, however, contain some changes in engineering and operational issues at the landfill. These changes include:

- Changes to final cover configuration – the revised final cover represents a vertical expansion and changes the overall configuration of the final cover. The changes in cover geometry will result in changes in storm water management and allowances for settlement.

- Change in waste stream volumes – the actual volume of waste being delivered to the landfill is less than the original permit estimates, resulting in increase landfill life.

- Final cover design – this permit application presents an alternate final cover design for the landfill cells. The final cover will consist of 30" on-site low permeability soils over the final lift of MSW.

- Plan of Operation – The Plan of Operation has been revised to reflect current operation practices.

The following items, which have been previously permitted and are part of the operating record of the landfill, and since no changes in site conditions have occurred, will not be discussed in detail in this permit application:

- Alternate Liner – an alternate liner consisting of the low-permeability site soils has been approved for use as a landfill liner at the Emery County Landfill. All future Phases will be constructed using the previously approved alternate liner.

- Leachate collection and removal system exemption – due to unique site conditions, Emery County Landfill has been exempted from the incorporation of a leachate collection and removal system. All future Phases will be constructed without leachate collection and removal systems. Visual monitoring for leachate is still conducted as part of landfill operations.

- Ground water monitoring exemption – due to the extreme depth of ground water, Emery County Landfill has been exempted from the UDEQ ground water monitoring requirements. Emery County plans to continue to operate the landfill consistent with the current exemption.

The application has been organized to follow the general outline of R315-302 and R315-310. This organization results in some duplication and repetition of information, but it is intended to simplify the review and approval of the permit application. Part I of this document duplicates the standard form outlining general data pertaining to the site. Part II is a general report that includes a facility description, legal description and a landfill operations plan. Part III is the Professional Engineering Report and includes details on the design and geohydrology of the site along with information on closure and post-closure plans.

PART I

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF SOLID AND HAZARDOUS WASTE

Application to Renew a Permit to Operate a Class I Landfill

PART I - General Data

1. Name of Facility: Emery County Landfill

2. Site Location: off road 550 west north of S.R.29, 2.4 miles thence 0.7 miles south on County landfill road
Castle Dale, Utah 84513

3. Facility Owner: Emery County

4. Facility Operator: Emery County Road Department

5. Contact Person: ***Rex Funk***, Road Supervisor/Landfill Manager

Address: Emery County Road Department
Post Office Box 889
Castle Dale, Utah 84513

Telephone: (435) 381-5450

6. Type of Facility:

(X) Class I Landfill
( ) Class V Landfill

( ) Initial Application
(X) Permit Renewal
Original Permit Number 9427

7. Property Ownership

(X) Presently Owned by Applicant 100% Undivided interest

( ) To be Purchased by Applicant

( ) To be Leased by Applicant

Property Owner (if different from applicant)

Name: None

Address: _____

Telephone: _____

8. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

IRA W. HATCH — (Name of Official)

COMMISSIONER — (Title)

Signature: Ira W Hatch Date: 10/18/05

SUBSCRIBED AND SWORN to before this 18th day of October 2005

My Commission expires on the 18th day of December 2008

Notary Public in and for Emery County, Utah.

(SEAL)

NOTARY PUBLIC
STATE OF UTAH
My Commission Expires
December 18, 2008
LESLIE J. BOLINDER
420 Molen Road P O Box 532
Ferron, Utah 84523

APPLICATION TO RENEW A PERMIT TO OPERATE A CLASS I LANDFILL

Emery County Landfill

PART II - GENERAL REPORT

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1.0 - FACILITY DESCRIPTION

Emery County owns and operates the Emery County Landfill located approximately 3.1 miles North of S.R. 29 off from 550 west north of Castledale, Utah. The landfill is a Class I municipal solid waste (MSW) disposal facility managed by the Emery County Road Department and is used primarily for the disposal of MSW generated within Emery County. The landfill has been continually operated by Emery County since the landfills development in 1979. The landfill is currently operating under Utah State Department of Environmental Quality Permit Number 9427. The facility is entirely fenced, with public access through the locking gate at the main entrance.

The Emery County Landfill is located in Section 16 of Township 18 South, Range 8 East, Salt Lake Base and Meridian. Drawing 1 (Appendix A) illustrates the location of the Emery County Landfill. The landfill site consisting of approximately 40 acres is bounded on the west by 380 plus acres of County owned properties available for future use.

1.1 AREA SERVED

The Emery County Landfill (Landfill) is the only active landfill in Emery County and serves the entire population of approximately 10,500. The majority of the residents of the County have curbside waste collection. The curbside collection program is currently contracted to City Sanitation located in Price.

1.2 WASTE TYPES

The Landfill takes in approximately 37 tons per day of waste. MSW constitutes the majority of the waste coming into the Landfill. Commercial wastes make up approximately 36 percent of the waste stream. Industrial and mine related wastes are not accepted at the Emery County Landfill.

Approximately 365 tons of green waste is diverted from the waste stream annually. Emery County Landfill is currently recycling tires, white goods, scrap metal and collecting green waste to be diverted from the waste stream. Approximately 74 tons of waste per year is currently being diverted from the landfill to be recycled.

1.3 HOURS OF SITE OPERATION

The Emery County Landfill is open to the general public and commercial haulers for solid waste disposal Tuesday through Friday from 9:00 a.m. to 5:15 p.m. and Saturdays from 8:00 a.m. to 4:15 p.m. The landfill maintains these hours year round. The facility is closed for the following Holidays:

- New Year's Day
- 4th of July
- Thanksgiving
- Christmas

The Emery County Landfill controls public access to the landfill to prevent illegal dumping of wastes, public exposure to hazards, scavenging, and unauthorized traffic. Access control is a key element in preventing unauthorized scavenging or injury. Fences, locked gates, and natural barriers provide the basis of the site's access control system. During operating hours, Emery County personnel monitor and control all access to facilities with at least one person on-site during all operational hours.

1.4 PERSONNEL

The following persons are responsible or available for on-site landfill operations for the Emery County Landfill:

- **Landfill Manager** - The Landfill Manager (LM) is responsible for planning and construction of the landfill facility and overall operation of the solid waste management system. The LM must also ensure the facility's compliance with the parameters of the permit issued by the DSHW through regular inspections and monitoring. The LM oversees the production of annual environmental and financial reports. In Emery County, the LM is currently the Supervisor of the County Road Department and reports to the County Commissioners. All landfill personnel report to the Landfill Manager.

  To fulfill these responsibilities adequately, the LM must have six to eight years of heavy equipment operation, with a minimal of five years supervisory experience. College training may be applied toward years of experience at the discretion of the County Commissioners. The Landfill Manager must complete the Solid Waste

Association of North America (SWANA) Manager of Landfill Operations (MOLO) course, or comparable training, within one year of being hired. Thereafter the LM must maintain active SWANA, MOLO and other applicable certification(s) as may be required for this position.

- **Solid Waste Technician Crewleader (SWTC)** - The SWTC oversees the daily operations of the landfill. Responsibilities include oversight of all landfill personnel, maintaining site operations, general site security and providing assistance to the Landfill Manager. The SWTC functions as the Landfill Manager in the Manager's absence.

- **Solid Waste Technician (SWT)** - All Landfill SWT's (Equipment Operators) are responsible for day-to-day activities of the Landfill. These responsibilities include waste acceptance and placement, safe operation and maintenance of equipment, visual inspection of each incoming load, random waste screening operations, application of daily, intermediate and final cover, and general maintenance of the facility.

  SWT's are required to have at least two years experience operating heavy equipment.

- **Solid Waste Screener** – The Solid Waste Screener is responsible for visual inspections of incoming loads, helping the SWT (Equipment Operators) with random waste screening, logging vehicles, record keeping, traffic control and clean up of litter.

  Emery County Landfill maintains at least one person at the gate to inspect/supervise incoming loads and one person to operate equipment and work the landfill face during all hours of operation.

2.0 - LEGAL DESCRIPTION

The legal description of the property Emery County owns for development of a landfill is:

> Southeast ¼ Northwest ¼ and Southwest ¼ Northeast ¼ of Section 16, Township 18 South, Range 8 East, Salt Lake Baseline and Meridian.

The property currently in use or planned for landfill development lies within the following area:

> Northwest ¼ of Northwest ¼ and Northeast ¼ of Northeast ¼ of Section 16, Township 18 South, Range 8 East, Salt Lake Baseline and Meridian. This corresponds to a latitude and longitude of approximately 39.255 degrees North and 111.025 degrees West.

The exact gate location (WGS 84 Datum) is latitude 39 degrees 15 minutes 44.3 seconds North, Longitude 111 degrees 1 minute 44.4 seconds West.

A copy of the legal description is included in Appendix B and a map of the Emery County Landfill is included as Drawing 1 (Appendix A).

2.1 Proof of Ownership

Deeds indicating proof of ownership are included in Appendix B.

2.2 Land Use and Zoning of Surrounding Areas

The Emery County Landfill is located consistent with all land use and zoning restrictions in effect in Emery County. The area surrounding the landfill is zoned I-1 (Industrial).

3.0 - OPERATIONS PLAN

On October 9, 1991, the U.S. Environmental Protection Agency (EPA) announced revisions to the Criteria for Classification of Solid Waste Disposal Facilities. These revisions were developed in response to Subtitle D of the 1984 Hazardous Waste Amendments to the Resource Conservation and Recovery Act (RCRA). The Subtitle D regulations set forth revised minimum federal criteria for municipal solid waste landfills (MSWLFs), including facility design and operating criteria. The Subtitle D regulations set forth differing requirements for existing and new units (e.g., existing units are not required to remove wastes in order to install liners).

Subtitle D established a framework for federal, state, and local government cooperation in controlling the management of non-hazardous solid waste. The federal role in this arrangement is to establish the regulatory direction by providing minimum nationwide standards for protection of human health and the environment and by providing technical assistance to States for planning and developing their own environmentally sound waste management practices. However, the actual planning, direct implementation, and enforcement of solid waste programs under Subtitle D remain largely a state and local function.

On November 5, 1995, the State of Utah Department of Environmental Quality (UDEQ) issued final Administrative Rules entitled Solid Waste Permitting and Management Rules (R315-301 through 320) implementing Subtitle D at the state level. UDEQ has received authorization from EPA to implement and enforce the solid waste program.

Emery County has prepared this Landfill Operations Plan to guide the daily operations at the Emery County Landfill. This document provides substantial discussion of operations at the landfill based on the operating criteria outlined in 40 CFR 258, Subpart C, and State of Utah Administrative Rules R315-301 through 310.

A supplementary document titled *Emery County Landfill Operator's Manual* contains detailed information regarding operating procedures for the day to day operation of the landfill. The *Emery County Landfill Operator's Manual* is not included with this permit. A copy of this Operator's Manual is maintained on file at the Landfill.

3.1 SCHEDULE OF CONSTRUCTION

The development of the Emery County Landfill has been presented in three Landfill Units comprising of 9 Phases. The current Landfill Unit receiving waste is the North Mass Fill Area (Phases 1-4), the next Landfill Unit scheduled to receive waste is the Southeast Excavated Area (Phases 5-7), with the final Landfill Unit to receive waste being the Southeast Mass Fill Area (Phases 8 and 9). Construction of the landfill site will be made according to the details presented in the drawings (Appendix A). These drawings show the conceptual configuration of each of the Landfill Unit's and their general location within the landfill site. The proposed configuration was developed based on geologic/hydrogeologic conditions and geotechnical considerations. Each additional Landfill Unit will be constructed when the previous operational phase is nearing its intermediate design capacity. Drawings in Appendix A illustrate the general sequencing of landfill development on the property.

The remaining capacity of the North Mass Fill Area (Phase 4) plus the next two Landfill Units, Southeast Excavated Area and the Southeast Mass Fill Area have airspace for approximately 17 years of disposal based on available fill volume, expected daily waste disposal rates, and an in-place density of 1,200 pounds per cubic yard (ppcy).

3.1.1 Sequence of Development

The following paragraphs describe the filling sequence for the remaining Phases of the Landfill Units. This sequencing will result in the planned placement of wastes to maximize the stability of the fill at any time during operation of the landfill. The SWT will not deviate substantially from the sequencing plan without concurrence of the Landfill Manager.

The Emery County solid waste plan defines the waste placement into three Landfill Units on the site with individual Phases within each Landfill Unit. The following nomenclature defines the Landfill Units and the Phases within each Unit.

3.1.1.1 Landfill Unit One - North Mass Fill Area (NMFA)

General

The NMFA is designed and constructed as a mass fill on top of a previously excavated and filled waste trench/pit system. The NMFA waste fill is designed to be completed in four Phases sequentially numbered 1 through 4. Phase 1 began at the northwest end of the mass in

1996. Each phase has realized lift insets (stair step) to accommodate the 4:1 end and side slopes of the final cover. The top of the Landfill Unit will be sloped at10:1 to maintain positive drainage and account for landfill settlement. The shape of the NMFA is roughly trapezoidal as indicated on Drawing 3 (Appendix A). The last Phase of the North Mass Fill Area is Phase 4. Phase 4 will start to accept waste in approximately May of 2003 and be completed and ready for final cover in December of 2008.

Waste Placement

Work face dimensions will be kept narrow enough to minimize blowing litter and reduce the amount of material needed for daily cover.

Typically, the compactor is operated with the blade facing uphill. Equipment operations across the slope are avoided to minimize the potential of equipment tipping over. In addition to safety concerns, a "toe of slope" to "crest of slope" working orientation provides the following benefits:

- Increases effective compaction.
- Increased visibility for waste placement and compaction.
- More uniform waste distribution.

The MSW wastes will be compacted by making three to five passes up and down the slope. Compaction reduces litter, differential settlement, and the quantities of cover soil needed. Compaction also extends the life of the site, reduces unit costs, and leaves fewer voids to help reduce vector problems. Care is taken that no holes are left in the compacted waste. Voids are filled with additional waste as they develop.

Intermediate cover is applied to all areas of the active cell where additional waste will not be received within 30 days. Intermediate cover consists of an additional 12 inches of soil being placed over the 6 inches of daily cover soil.

Waste will be placed in typical 8 foot tall lifts covered with 6" of daily cover. An additional 12" of soil will be placed on all horizontal lifts to constitute an intermediate cover. The MSW will be placed to the final cover contours as indicated in Drawing 3 (Appendix A).

3.1.1.2 Landfill Unit Two - Southeast Excavated Area (SEA)

General

The SEA will be constructed and completed in three Phases (Phases 5, 6, and 7). Phase 5 will begin with phase wastes being placed in an existing excavated borrow pit measuring approximately 120' wide and 140' long. The depth of the excavation is approximately 25' below surrounding surface. Phases 6 and 7 will be sequential operations within the same excavated area as Phase 5. Additional excavation will be performed as required to reach the contours as indicated in Drawing 4 (Appendix A). Phase 5 will start to accept waste in approximately December of 2006 and be completed and ready for intermediate cover in April of 2007. Phase 6 will start operation upon the completion of Phase 5 with final capacity being reached in approximately April of 2010. Phase 7 will commence operation once Phase 6 is at capacity and is anticipated to be complete in April of 2012.

Waste Placement

Waste placement will be accomplished utilizing the same waste procedures as the NMFA. Each Phase, beginning with Phase 5 will be completed to the above ground level before progressing to the next sequential phase. Intermediate cover will be applied to all landfill surfaces as they reach the final elevation of the Phase. When all these Phases of the SEA are filled to an elevation just above the surrounding topography, the entire SEA will be uniformly graded in preparation for the last of the Landfill Units – the Southeast Mass Fill Area.

3.1.1.3 Landfill Unit Three - Southeast Mass Fill Area (SMFA)

General

The SMFA is designed to be a mass fill in two Phases placed on top of the Southeast Excavated Area (SEA). The SMFA will begin with Phase 8 and end with Phase 9. Phase 8 will begin operation once Phase 7 is complete, estimated to be April of 2012. Phase 8 will reach final capacity in approximately September of 2016. Phase 9 is the last Phase of the Southeast Mass Fill Area and the last Phase currently planned for the Emery County Landfill. Phase 9 will become operational upon the completion of Phase 8 and will reach design capacity in approximately April of 2020.

Waste Placement

Waste placement will be accomplished utilizing the same waste procedures as the MNFA and the SEA. Once each Mass fill area is completed, final cover will be installed. Drawing 5 illustrates the final contours of the SEA unit and the composition of the final cover system.

3.2 DESCRIPTION OF HANDLING PROCEDURES

3.2.1 General

The landfill is open for public and private disposal. Signs posted near the landfill entrance clearly indicate the following information:

- Types of wastes that are accepted
- Types of wastes not accepted
- Telephone numbers
- Hours of operation
- Recycling information
- Holidays – days of landfill operation
- Tipping fees
- Applicable regulations

All vehicles delivering wastes to the site must stop at the scalehouse. Scalehouse personnel will inquire as to the contents of each incoming load to screen for unacceptable materials. Any vehicle suspected of carrying unacceptable materials (liquid waste, sludges, or hazardous waste) will be prevented from entering the disposal site unless the driver can provide evidence that the waste is acceptable for disposal at the site. Emery County Landfill reserves the right to refuse service to any suspect load. Vehicles carrying unacceptable materials will be required to exit the site without discharging their loads. If a load is suspected of containing unacceptable materials, the following information will be recorded: date, time, name of the hauler, driver, telephone number, license plate, and source of waste. The scalehouse will then notify the tipping area operator by radio that a load is suspect and that load will be further inspected at the landfill tipping area before final disposal is allowed.

After a vehicle leaves the scalehouse, the vehicle will be routed to the appropriate discharge location by site personnel. Loads will be regularly surveyed at the tipping area. If a discharged load contains inappropriate or unacceptable material, the discharger will be required to reload

the material and remove it from the landfill site. If the discharger is not immediately identified, the area where the unacceptable material was discharged will be cordoned off. The unacceptable material will be moved to a designated area for identification and preparation for proper disposal.

The operation of the landfill is documented on various forms. The forms that Emery County uses to help maintain an orderly processing of waste while minimizing the potential for environment impacts are:

- Landfill Inspection
- Routine Waste Inspection
- Landfill Recyclables Hauled Out
- Utah DIYer Used Oil Log
- Landfill Training Agenda
- Freon Extraction
- Landfill Waste Disposal Log
- Landfill Hot Load
- Landfill Gas Log

Copies of all forms are included in Appendix C.

3.2.2 Waste Acceptance

The Emery County Landfill utilizes customized spreadsheets in Quatro Pro to manage the landfill waste tracking. With this program Emery County is able to track all incoming waste as well as bill and receive payment from all customers. When a vehicle with waste stops on the scale; the scale operator identifies the load as to whether it is a commercial hauler, general public, or private individual with an account. All loads larger than a pickup are weighed and charged accordingly. All information pertaining to all transactions is stored on the in house computer at the Road Department. All records are backed up twice weekly to the main frame at the County Court House. A monthly summary of all landfill transactions is created and kept on file at the landfill. Any or all transactions may be retrieved as necessary. After each load has been recorded, the driver is directed where to take the load. All loads with the exception of green waste and dead animals are directed to the working face where the waste is deposited for disposal.

Each load is visually inspected. Waste screening is done as needed or scheduled according to the procedures outlined in Section 3.3 Waste Inspection. No open burning is allowed. No smoking is allowed near the work face.

3.2.3 Waste Disposal

Wastes are dumped at the toe of the work face when possible and spread up the slope in one to two foot lifts, keeping the slope at three to one (horizontal to vertical) configuration.

Work face dimensions are kept narrow enough to minimize blowing litter and reduce the amount of material needed for daily cover. Typically, the width of the working face is two and one-half times the width of the compactor blade (40 feet). This facilitates complete compaction of the waste and keeps the width narrow enough to minimize amount of daily cover required.

Typically the compactor is operated with the blade facing uphill. Equipment operations across the slope are avoided to minimize the potential of equipment tipping over. In addition to safety concerns, a toe of slope to crest of slope working orientation provides the following benefits:

- Minimizes blowing litter problems.
- Increases equipment compactive effectiveness.
- Increased visibility for waste placement and compaction.
- More uniform waste distribution.

Grade stakes are used when necessary to control cell height and top surface grade. The top of the surface grade ranges from 2 to 5 percent, and the cell height ranges form 8 to 10 feet.

Wastes are compacted by making three to five passes up and down the slope. Compaction reduces litter, differential settlement, and the quantities of cover soil needed. Compaction also extends the life of the site, reduces unit costs, and leaves fewer voids to help reduce vector problems. Care is taken that no holes are left in the compacted waste. Voids are filled with additional waste as they develop.

Intermediate cover is applied to all areas of the active cell that will not receive additional waste within 30 days. Intermediate cover consists of additional 12 inches of soil being placed over the 6 inches of daily cover soil.

3.2.4 Special Wastes

3.2.4.1 Used Oil and Batteries

The Emery County Landfill is a "Used Oil Recycle Center". When a customer has used oil to dispose of they fill out the form "UTAH DIYer USED OIL LOG" provided by UDEQ. A report generated from this form is turned in quarterly stating the amount of oil deposited and the customer's names. Batteries are not accepted at the working face. Emery County Landfill provides a pallet near the scalehouse where incoming batteries are stored until a sufficient number is generated to facilitate pickup by a local battery supplier (J&D Automotive).

3.2.4.2 Bulky Wastes

White goods are accepted at the landfill and are separated for recycling. All appliances containing refrigerants are segregated in a separate area. Refrigerant is removed from the damaged units and the recyclable appliances are set aside in a special area for recycling. Used cars are not accepted at the Emery County Landfill.

3.2.4.3 Tires

Emery County Landfill accepts small quantities of tires from the general public. Commercial haulers are prohibited from disposing of tires. Four passenger tires can be accepted with each load from the public. When sufficient quantities of tires are collected, a tire hauler is called and the tires are removed from the facility for recycling.

3.2.4.4 Dead Animals

Dead animals are accepted at the landfill. A designated trench is prepared for the acceptance of these animals. They are collected in the trench and a minimum of 6" of cover is placed over the animals at the end of each day. In the event the trench is inaccessible, the dead animals are incorporated into the face of the landfill. The incorporation of the carcasses into the landfill is accomplished by pushing up the toe of the face and depositing the animal in the bottom of the toe; waste is then pushed over the top of the animal.

3.2.4.5 Asbestos Waste

Emery County Landfill has developed asbestos management procedures to minimize the risk of asbestos related waste to humans and the environment. Emery County Landfill accepts on locally generated asbestos waste. Asbestos generators and transporters are required to make arrangements for asbestos disposal at a minimum of 24 hours prior to delivery to the landfill.

The Emery County Landfill has developed asbestos management procedures to minimize the risk of asbestos related waste to humans and the environment. Emery County Landfill accepts all locally generated asbestos waste. Asbestos generators and transporters are required to make arrangements for asbestos disposal at a minimum of 24 hours prior to delivery to the landfill.

Asbestos wastes shall be handled, transported, and disposed in a manner that will not permit the release of asbestos fibers into the air and must otherwise comply with Sections R307-1-4.12 and R307-8 and 40 CFR Part 61, Subpart M, 1995ed.

- Accept asbestos wastes by appointment only. Require a 24 to 48 hour notice.

- Do not accept friable asbestos waste unless it has been double bagged in plastic bags of 6-mil or thicker, and thoroughly wetted to prevent fiber release. Asbestos slurries must be in leak-proof and air-tight rigid containers if they are too heavy for plastic bags.

- All asbestos containers must be labeled with the name of the waste generator, the location where it was generated, and tagged with a warning label that conforms to the requirements of 40 Code of Federal Regulations (CFR) Part 61.149(2), 1991 ed.

- Upon arriving at the gate, the transporter of the asbestos must present a waste shipment record. The Solid Waste Technician (SWT) will verify the quantities received and sign the waste shipment record. Emery County Landfill personnel will send a copy of the waste shipment record to the generator within 30 days.

- Direct the transporter to the asbestos trench for off-loading. Caution the transporter to take care not to break the containers. Cover the wastes immediately with at least 12 inches of soil.

- Do not compact asbestos wastes until they are completely covered with a minimum of 12 inches of non-asbestos material.

- Restrict public access to areas containing asbestos. The asbestos containing areas are to be properly marked. Warning signs will be placed at the entrance and around the perimeter of the disposal area at distances not exceeding 200 feet.

3.2.4.6 Grease pit and Animal Waste By-Products

Waste from restaurant grease traps and slaughterhouse by-products are accepted at the landfill. These wastes require 24 to 48 hour notice before disposal. If the waste passes the paint filter test, it is deposited in the dead animal trench and covered daily. If excess liquid is present in the waste, the waste is unloaded on a specially prepared drying pad. The waste remains on the drying pad until the moisture has been sufficiently reduced to pass the paint filter test. Once the waste passes the paint filter test, the waste is deposited either in the dead animal trench or at the toe of the working face where it is immediately covered.

The paint filter test is used to determine if any free liquids are contained in the waste. The paint filter test must be conducted as defined by Method 9095 (Paint Filter Liquids Test) and described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods" (EPA Pub No. SW846).

3.2.4.7 Infectious Wastes

The Emery County Landfill will occasionally accept potentially infectious waste (sharps from nursing home), specific waste handling procedures will be followed to minimize the potential human contact with the infectious waste. The following procedures will constitute the Infectious Waste Management Plan:

- Upon entering the landfill, the transporter of infectious waste shall notify the landfill operator that the load contains infectious waste.
- The infectious waste containers will be placed at the bottom of the working face with sufficient care to avoid breaking them.
- The infectious waste will be immediately and completely covered with a minimum of 12 inches of soil or MSW that contains no infectious waste.
- The infectious waste will not be compacted until the 12 inches of soil or MSW containing no infectious waste is in place.

- Infectious waste may be placed in the dead animal pit as an alternative to disposal at the working face.

3.2.4.8 Bulk or Containerized Liquid Waste

Bulk or containerized liquid waste will not be disposed of in the Emery County Landfill unless it is household waste. Liquids restrictions are necessary because the disposal of liquids into landfills can be a potential source of leachate generation. By restricting the introduction of free liquids into the landfill, Emery County Landfill can minimize the leachate generation potential of the landfill. This should reduce the quantity of free liquids to be managed in the landfill. The ban on containerized free liquids will also reduce the problem of subsidence and possible damage to the final cover upon deterioration of the waste containers.

3.3 WASTE INSPECTION

3.3.1 Landfill Spotting

Learning to identify and exclude prohibited and hazardous waste is necessary for the safe operation of the Landfill. The SWT's are required to receive initial and periodic hazardous waste inspection training. SWT are required to take the SWANA waste screening training. Certificates of training are kept in the personnel files.

Hazardous wastes have either physical or chemical characteristics that could harm human health or the environment. A waste is considered hazardous if it falls into either of two categories: 1) a listed waste, or 2) a characteristic waste. Hazardous wastes are not accepted at the Emery County Landfill.

Small quantity generators (<100 kg/mo) and household quantities are exempt from hazardous waste regulations. However, hazardous wastes are most likely to enter the Landfill mixed in with common household waste. Public education and periodic waste screening are the tools used to minimize the amount of inadvertent hazardous waste entering the landfill.

3.3.2 Random Waste Screening

Random inspections of incoming loads are conducted according to the schedule established by the SWTC. One or more commercial waste haulers and residential loads per week are selected

randomly according to the schedule. If frequent violations are detected, additional random checks are scheduled at the discretion of the Landfill Manager.

If a suspicious or unknown waste is encountered, the SWT proceeds with the waste screening as follows:

- The driver of the vehicle containing the suspect material is directed to the waste screening area.
- The waste screening form is completed.
- Protective gear is worn (leather gloves, steel-toed boots, goggles, coveralls, and hard hat).
- The suspect material is spread out with the wheel loader or hand tools and visually examined. Suspicious marking or materials, like the ones listed below, are investigated further:
  - Containers labeled hazardous
  - Material with unusual amounts of moisture
  - Biomedical (red bag) waste
  - Unidentified powders, smoke, or vapors
  - Liquids, sludges, pastes, or slurries
  - Asbestos or asbestos contaminated materials
  - Batteries
  - Other wastes not accepted by the Landfill

- The Landfill Manager is called if unstable wastes that cannot be handled safely or radioactive wastes are discovered or suspected.

3.3.3 Removal of Hazardous or Prohibited Waste

Should hazardous or prohibited wastes be discovered during random waste screening or during tipping, the waste is removed from the Landfill as follows:

- The waste is loaded back on the hauler's vehicle. The hauler is then informed of the proper disposal options.
- If the hauler or generator is no longer on the premises and is known, they are asked to retrieve the waste and informed of the proper disposal options.

- The Landfill Manager arranges to have the waste transported to the proper disposal site and then bill the original hauler or generator.

A record of the removal of all hazardous or prohibited wastes is kept in the site operational records.

3.3.4 Hazardous or Prohibited Waste Discovered After the Fact

If hazardous or prohibited wastes are discovered in the landfill, the following procedure is used to remove them:

- Access to the area is restricted.
- The Landfill Manager is immediately notified.
- The SWT removes the waste from the working face if it is safe to do so.
- The waste is isolated in a secure area of the landfill and the area cordoned off.
- The Emery County Sheriff's Department Hazmat Response Team is notified. The Response Team physically inspects the material and provides waste handling specifics for the disposal.

The DSHW, the hauler (if known), and the generator (if known) is notified within 24 hours of the discovery. The generator (if known) is responsible for the proper cleanup, transportation, and disposal of the waste.

3.3.5 Notification Procedures

The following agencies and people are contacted if any hazardous materials are discovered at the Landfill:

- Rex Funk, Landfill Manager ..... (435) 381-5450
- Southeastern Utah Health Department ..... (435) 637-3671
- Director, DSHW ..... (801) 538-6170
- Emery Co. Sheriff's Office..... (435) 381-2404

A record of conversation is completed as each of the entities is contacted. The record of conversation is kept in the site operational records.

3.4 MONITORING AND INSPECTION SCHEDULE

3.4.1 Groundwater

Emery County Landfill is not required to monitor groundwater as part of the landfilling operations at the Emery County Landfill; therefore, no inspections or maintenance activities are required.

3.4.2 Surface Water

Drainage control problems can result in accelerated erosion of a particular area within the landfill. Differential settlement of drainage control structures can limit their usefulness and may result in a failure to properly direct storm water off-site. Drawing 2 (Appendix A) illustrates the location of the surface water drainage control features designed to incorporate both existing topographical features as well as changes to the overall site layout. Landfill staff will inspect the drainage system monthly. Temporary repairs will be made to any observed deficiencies until permanent repairs can be scheduled.

3.4.3 Leachate Collection

Leachate is not collected as part of the landfilling operations at the Emery County Landfill; therefore, no inspections or maintenance activities are required.

3.4.4 Landfill Gas

This facility is monitored for methane gas on a quarterly basis. Concentrations of methane gas are measured with a hand-held gas monitor. Gas readings are recorded at each end of the active cell, the shop, fuel tanks, scalehouse, and other random locations. Readings are recorded on the methane log sheet and kept on file in the scalehouse. Gas monitoring activities at the Emery County Landfill are performed by the local health department (Southeastern Utah Health).

If methane releases are detected in excess of 25 percent of the LEL, in the landfill building or more than 100 percent of the LEL at the property boundary, the procedure outlined in the "Explosive Gases" section is followed.

3.4.5 Inspection Documentation

The results of all routine inspections of site facilities will be recorded on inspection forms. The inspection forms will be submitted to the Landfill Manager for inclusion in the landfill operating records as required in Section R315-302-2(5) of the Rules. Copies of all landfill forms utilized to document landfilling activities are included in Appendix C.

3.5 CONTINGENCY AND CORRECTIVE ACTION PLANS

The following sections outline procedures to be followed in case of fire, explosion, ground water contamination, release of explosive gases, or failure of the storm water management system.

The SWTC has an on-site mobile communications system for use in an emergency to communicate with the management offices and off-site personnel. Additional available communication is the telephone located in the scale house, which will serve as the back-up communication system.

3.5.1 Fire

3.5.1.1 Incoming Waste/ Incoming Vehicle Fire

The potential for fire is a concern in any landfill. The Emery County Landfill follows a waste handling procedure to minimize the potential for a landfill fire. If any load comes to the landfill on fire, the vehicle will be directed to a designated section of the landfill, away from any exposed waste, and allowed to deposit the material. The designated area will vary depending on operational areas in use. The area will be readily accessible and within 1 or 2 minutes of the tipping area. The designated area will be isolated from the existing tipping area and will either be an excavated area with no underlying fill or at a location with a minimum of 1 foot of soil cover over underlying fill. In no case will a load thought to be burning be allowed to be dumped in the landfill.

Once burning waste is removed from the vehicle, the application of cover soil by landfill earth-moving equipment or the application of water by the on-site water truck to extinguish the fire can be carried out. Smothering the fire with soil is the preferred method. If, at any time, additional assistance is required, local fire-fighting units will be contacted. Once the

burning waste cools and is deemed safe, the material is then be incorporated into the working face.

3.5.1.2 Ground Fire/Below Cover Fire

In the event that waste placed on the ground or waste that was previously covered erupts into fire, the material will be isolated from previously deposited waste as much as possible and the local fire department advised. This may be done by either moving burning wastes to another area or by concentrating the burning wastes using the landfill earth-moving equipment.

Once burning material is separated from other exposed waste, the application of cover soil by landfill earth-moving equipment or the application of water by a water tank truck to extinguish the fire can be carried out.

If, at any time, additional assistance is required, local fire-fighting units should be contacted as-soon-as possible.

3.5.2 Explosion

In the event that an explosion should occur or seem eminent at the landfill or in any structure associated with the landfill site, all personnel in the area, including those in surrounding buildings, will be evacuated immediately. In addition, site equipment will be moved away from the scene, if possible.

All landfill personnel will be accounted for and local emergency personnel (fire, police) will be contacted and informed of the situation. The Landfill Manager will be immediately informed of the situation and will notify the Executive Secretary immediately.

The explosion area will be restricted to both landfill personnel and residents until cleared for re-entry by local emergency personnel.

3.5.3 Release of Explosive Gases

Methane gas generation and concentration is not anticipated to be a problem at the Emery County Landfill. However, due to the production of methane in all landfills, landfill gas levels are monitored quarterly. If a concentration of methane is detected in excess of 25 percent of

the LEL in a landfill building, or 100 percent of the LEL at the property boundary, the following procedure is followed:

- All landfilling operations cease immediately. All personnel in the area, including those in surrounding buildings, will be evacuated immediately. In addition, site equipment will be moved away from the scene, if possible.

- All landfill personnel will be accounted for.

- Local emergency personnel (fire, police) will be contacted and informed of the situation.

- The Landfill Manager will be informed of the situation.

- The release area and surrounding area will be monitored with a combustible gas indicator (CGI) by landfill personnel and readings documented for placement into the operating record.

- The release area will be restricted to both landfill personnel and residents until cleared for re-entry by local emergency personnel.

The Emery County Landfill Manager will notify the Executive Secretary immediately and prepare a written report to be submitted within 14 days of detecting the release. The gas levels detected and a description of the steps taken to protect human health are placed in the operating record within 60 days of detection and the Executive Secretary is notified that the plan has been implemented.

3.5.4 Failure of Run-Off Containment

The purpose of the run-on/run-off control systems is to manage the storm water falling in or near the landfill. Water is diverted away from the landfill using a series of ditches. These ditches are inspected on a regular basis and repaired as needed. All water falling on the working face is unable to flow out of the working area due to surface depressions left by the compactor. All storm water falling or flowing near the active landfill cell is prevented from flowing into the active area by diversion berms and ditches.

If the run-on or run-off system fails, temporary measures such as temporary berms, ditches, or other methods are used to divert water from the active landfill cell. The following actions will be taken to minimize the impact to the facility:

- Landfill personnel will immediately suspend filling operations, if containment failure is in an active fill area.

- Landfill personnel will use earth-moving equipment to construct temporary earthen berms in an effort to divert the flow of surface water away from the failure area and toward a holding area.

- The Landfill Manager will conduct damage assessment. A decision will be made as to whether the damage can be rectified by on-site personnel.

- If the damaged area cannot be reconstructed by on-site personnel, Emery County Landfill will notify the Emery County Road Department for assistance. If the damage is such that the Emery County Road Department can not repair the damage within 1 week, the Emery County Landfill Manager will contact a contractor to either re-design the containment system or initiate repairs to the existing system.

- The Emery County Landfill Manager will provide the necessary notices to the Executive Secretary and fully document the event in the operating record, including corrective action within 14 days.

3.5.5 Groundwater Contamination

If ground water contamination is ever suspected, studies to confirm contamination will be conducted and the extent of contamination documented. This program may include the installation of ground water monitoring wells. A ground water monitoring program would be developed and corrective action taken as deemed necessary, with the approval of the Executive Secretary.

3.6 CONTINGENCY PLAN FOR ALTERNATIVE WASTE HANDLING

Based on historical operations and a history of never needing to close down the site, landfilling operations should not have to be suspended due to inclement weather conditions or

interruption of service. Emery County Landfill believes that their past operating experience and cautious operating procedures will negate the need for alternate waste handling plans.

3.7 MAINTENANCE PLAN

The following subsections offer a description of the maintenance of installed landfill equipment systems.

3.7.1 Groundwater Monitoring System

Emery County Landfill is not required to monitor groundwater as part of the landfilling operations at the Emery County Landfill; therefore, no maintenance will be required.

3.7.2 Leachate Collection and Recovery System

Leachate is not collected as part of the landfilling operations at the Emery County Landfill; therefore, no maintenance activities will be required.

3.7.3 Gas Monitoring System

Emery County Landfill is not required to collect landfill gas as part of the landfilling operations at the Emery County Landfill; therefore, no maintenance will be required.

3.8 DISEASE AND VECTOR CONTROL

The vectors encountered at the Emery County Landfill are flies, birds, mosquitoes, rodents, skunks, and snakes. Due to the rural location of the landfill, stray house pets are occasionally encountered at the landfill. The program for controlling these vectors is as follows:

3.8.1 Insects

Eliminating breeding areas is essential in the control of insects. Emery County Landfill minimizes the breeding areas by covering the waste daily and maintaining surfaces to reduce ponded water. The mosquito abatement district personnel assist the landfill as necessary.

3.8.2 Rodents

Reducing potential food sources minimizes rodent populations at the landfill. To date, no significant numbers of mice or rats have been observed. The potential food sources are minimized by properly applying daily cover.

In the event of a significant increase in the number of rodents at the landfill, a professional exterminator will be contacted. The exterminator would then establish an appropriate protocol for pest control in accordance with all county, state and federal regulations.

3.8.3 Birds

The Emery County Landfill has had minimal problems with birds (crows). Good landfilling practices of waste compaction, daily covering of working faces, and the minimization of ponded water has to date alleviated most of the bird problems. When the occasional need arises, the birds are encouraged to leave by using cracker and whistler shells.

3.8.4 Household Pets

Because of the landfill's location, some stray cats and dogs have wandered onto landfill property. When stray animals are encountered (and can be caught), they are turned over to the animal shelter. If we are unable to apprehend the animals, they are chased off the property. If the animals return and cannot be caught, lethal methods are used to eliminate the problem.

3.8.5 Wildlife

Emery County Landfill has a variety of wildlife located on or near the landfill property. Wildlife includes deer, snakes, foxes, skunks, and coyotes. The only operational problems with wildlife to date have been with an occasional skunk or snake. When problem skunks or snakes are encountered, they are exterminated. If other site wildlife becomes a problem, the landfill will coordinate with the Division of Wildlife Resources to provide methods and means to eliminate the problem.

In the event that any of these vectors become an unmanageable problem, the services of a professional exterminator will be employed.

3.8.6 Fugitive Dust

The roads leading to the landfill and the landfill face are paved, however; landfill construction activities and daily traffic produce a certain amount of dust. Landfill activities compounded by the occasional high wind present a fugitive dust problem. If the dust problem elevates above the "minimum avoidable dust level", the landfill applies water to problem areas.

The landfill has access to a water truck that is maintained by the Emery County Road Department. Water is applied to the unpaved surfaces receiving traffic within the landfill in compliance with the Utah Division of Air Quality requirements. Water or a dust palliative is applied as often as needed in order to control the dust on site.

3.8.7 Litter Control

Due to the nature of landfilling operations, litter control is an ongoing problem. Landfill personnel perform routine litter cleanup to keep the landfill and surrounding properties clear of windblown debris.

Whenever possible, the working face is placed down wind so that blowing litter is worked into the landfill face. During windy conditions, landfill personnel minimize the spreading of the waste to reduce the amount of windblown debris

3.9 RECYCLING PROGRAM

Emery County Landfill has a somewhat limited recycling program due to its relatively small daily waste streams and the logistical remoteness from viable recycling markets. Deseret Industries has been allowed space at the facility to place a collection van. Landfill patrons are encouraged to recycle useful items through the Deseret Industries program. The full collection vans are replaced monthly with an empty van.

Metal products are periodically separated from the landfill waste stream when practical and when the recycled metal market will pay for the costs of the metal diversion. The exception to the metal recycling program as stated above is when large structural members are exposed in the waste stream, those structural members are set aside for County use.

Appliances are inspected with recyclable units being set aside for recycling by a local appliance dealer. Useable paints and some building materials are set aside weekly for reuse by landfill patrons.

The Emery County Landfill serves as an oil recycling center. Do-It-Yourselfers oil and antifreeze are gathered and disposed of under the guidelines of the State program. Batteries brought to the landfill or discovered as part of the daily operation are collected and stored on a pallet to be recycled by a local battery dealer.

A modest effort is made to separate and compost clean organic matter. The organic matter is made available to the public at no cost.

3.10 TRAINING PROGRAM

Emery County Landfill personnel will be trained on how to identify unacceptable waste including liquid wastes, sludge, potential regulated hazardous waste, and PCB wastes. Personnel to be trained will include the SWTC, and all SWT. The training will emphasize methods of identifying containers and labels typical of hazardous and PCB waste. Training will also address the proper handling of unacceptable waste. All employees will receive on the job training in landfill operations and waste screening. This training will include operations and safety training. New employees will receive training during their first 3 months of employment. The Landfill Manager will be trained and certified as a Manager of Landfill Operations (MOLO). Upon completion of 5 years of landfill experience, the SWTC will receive the MOLO training.

3.11 RECORDKEEPING

Emery County Landfill personnel will maintain an operating record which will be available at the Emery County offices. This record will include: inspection records, training procedures, notification procedures; methane monitoring results and remediation plans, if required; closure and post-closure care plans; financial assurance documentation and cost estimates.

Records will be kept throughout the life of the facility, including post-closure care. Documents will be organized, legible, dated, and signed by the appropriate personnel. The information in the operating record will be available to citizens through the Utah Government Records Access Management Act (GRAMA).

3.11.1 Weights or Volumes of Incoming Waste

Emery County Landfill will record and retain in the operating record all documentation made with respect to any weights or volumes of incoming wastes as allowed by State of Utah Administrative Rule R315-302-2. An annual summary of scale records will also be placed into the operating record.

3.11.2 Number of Vehicles Entering Facility

Emery County Landfill will record and retain in the operating record all documentation made with respect to the number of vehicles entering the facility as allowed by State of Utah Administrative Rule R315-302.

3.11.3 Types of Wastes Received Each Day

Emery County Landfill will record and retain in the operating record all documentation made with respect to the types of waste received each day at the facility as allowed by State of Utah Administrative Rule R315-302.

3.11.4 Deviation from Approved Operations Plan

At any time during the operational life or post-closure care period of the Emery County Landfill, UDEQ may set alternative schedules for recordkeeping and notification. However, it is anticipated that any modifications to the schedule for recordkeeping will be discussed with Emery County Landfill personnel prior to official notice from the State of Utah.

3.11.5 Training Procedures

Emery County Landfill will record and retain in the operating record all documentation made with respect to any training programs or procedures as allowed by State of Utah Administrative Rule R315-302.

3.11.6 Inspection Log or Summary

Emery County Landfill will record and retain in the operating record all documentation made with respect to any inspection logs or summary sheets as allowed by State of Utah Administrative Rule R315-302

3.11.7 Closure and Post-Closure Care Plans

Emery County Landfill will record and retain in the operating record all documentation made with respect to the closure and post-closure care plans as allowed by State of Utah Administrative Rule R315-302-3.

3.11.8 Cost Estimates and Financial Assurance Documentation

Emery County Landfill will record and retain in the operating record all documentation made with respect to the cost estimates and financial assurance documentation as allowed by State of Utah Administrative Rule R315-309.

3.11.9 Other Records as Required by the Executive Secretary

Emery County Landfill will record and retain in the operating record all documentation made with respect to other processes, variances, and violations as required by the State of Utah.

3.12 SUBMITTAL OF ANNUAL REPORT

Emery County Landfill will submit a copy of its annual report to the Executive Secretary by March 1 of each year for the most recent calendar or fiscal year of facility operation. The annual report will include facility activities during the previous year and will include, at a minimum, the following:

- Name and address of facility.
- Calendar or fiscal year covered by the annual report.
- Annual quantity, in tons or volume, in cubic yards, and estimated in-place density in pounds per cubic yard of solid waste handled for each type of treatment, storage, or disposal facility, including applicable recycling facilities.
- Annual update of required financial assurances mechanism pursuant to Utah Administrative Code R315-309.
- Results of gas monitoring.
- Training programs completed.

3.13 INSPECTIONS

The Landfill Manager, or his/her designee, will inspect the facility to prevent malfunctions and deterioration, operator errors, and discharges that may cause or lead to the release of wastes to the environment or to a threat to human health. These inspections will be conducted on a quarterly basis, at a minimum. An inspection log will be kept as part of the operating record. This log will include at least the date and time of inspection, the printed name and handwritten signature of the inspector, a notation of observations made, and the date and nature of any repairs or corrective actions. Inspection records will be available to the Executive Secretary or an authorized representative upon request.

3.14 RECORDING WITH COUNTY RECORDER AND THE STATE OF UTAH DIVISION OF SOLID AND HAZARDOUS WASTE

Plats and other data, as required by the County Recorder, will be recorded with the Emery County Recorder as part of the record of title no later than 60 days after certification of closure. Additionally, Emery County Landfill will submit proof of record of title filing to the Executive Secretary.

3.15 STATE AND LOCAL REQUIREMENTS

The Emery County Landfill will maintain compliance with all applicable state and local requirements including zoning, fire protection, water pollution prevention, air pollution prevention, and nuisance control.

3.16 SAFETY

Landfill personnel are required to participate in an ongoing safety program. This program complies with the Occupational Safety and Health Administration (OSHA), and the National Institute of Occupational Safety and Health (NIOSH) regulations as applicable. This program is designed to make the site and equipment as secure as possible and to educate landfill personnel about safe work practices.

First Aid and CPR training is provided to all landfill personnel by the Emery County Road Department Safety Technician every 2 years. The name of each person to have a first aid certificate is posted beside the telephone numbers. It is preferable to have one first aid certified personnel on site during all normal operating hours.

3.17 EMERGENCY PROCEDURES

In the event of an accident or any other emergency situation, the Equipment Operator notifies the Landfill Operator Crewleader who immediately contacts the Landfill Manager and proceeds as directed. If the Landfill Manager is not available, the Landfill Operator Crewleader calls the appropriate emergency number posted by the telephone. The emergency telephone numbers are:

- Emery County Central Dispatch 911
- Fire Department 911
- Sheriff's Office ..... (435) 381-2404
- Highway Patrol ..... (435) 637-0893
- Carbon/Emery County Fire Marshal ..... (435) 637-0893
- Castleview Hospital ..... (435) 637-4800
- Rex Funk, Landfill Manager ..... (435) 381-5450
  Cell (435) 749-2800

APPLICATION TO RENEW A PERMIT TO OPERATE A CLASS I LANDFILL

Emery County Landfill

PART III - TECHNICAL AND ENGINEERING REPORT

TABLE OF CONTENTS

1.0 - GEOHYDROLOGICAL ASSESSMENT

1.1 GEOLOGY AND HYDROLOGY

1.1.1 Regional Geology

The Emery County Landfill is located near the western boundary of Castle Valley, in the Mancos Shale Lowlands section of the Colorado Plateau (Witkind, 1995; Hintze, 1993; Hintze, 1980; Stokes, 1986). Castle Valley is an erosional valley located in the western portion of the Colorado Plateau Province, within a series of northerly-dipping Cretaceous age units that form the sinuous margin between the southern Uinta Basin and the San Rafael Swell. These Cretaceous age strata comprise the Book Cliffs, Roan Cliffs and other prominent topographic rises. The Colorado Plateau Province is characterized by high plateaus and intervening lowlands, which contain relatively continuous geologic strata. These plateaus were not as widely affected by the prevalent large-scale normal faulting that characterizes the Basin and Range Province farther to the west. The Lowlands are the largest region of level land in central and eastern Utah, extending from the town of Emery eastward to Utah's border with Colorado. The western edge of the Mancos Shale Lowlands occurs at the eastern edge of the Great Basin-Colorado Plateau Transition Province, adjacent to the Wasatch Plateau.

Surface drainages flow eastward out of the Wasatch Plateau, across Castle Valley to Green River. The Mancos Shale Lowlands are crossed by only a few permanent streams and by a great number of intermittent washes draining higher country to the north and west.

Groundwater resources are limited near the Emery County Landfill. Small quantities of ground water (less than 10 gallons per minute) are produced in the southern portion of Castle Valley from the Ferron Sandstone Member of the Mancos Shale. Groundwater quality is poor, with total dissolved solids (TDS) usually exceeding 3,000 milligrams per liter (mg/l) (Lines and Morrissey, 1983).

1.1.2 Local Geology

The Emery County Landfill has been constructed on Wilberg Flat, a young pediment surface in the eastern half of section 16. Much of the pediment gravel on Wilberg Flat was formed by erosion and redeposition of older pediment gravel exposed at higher elevations on Danish

Bench, to the west of the Landfill. The balance of the gravel was eroded directly from sandstones that cap the Mancos Shale in bluffs five miles northwest of the Landfill.

Wilberg Flat is underlain by the Main Body of the Blue Gate Member consists of light-bluish-gray and gray, thin- to medium-bedded shale and shaley siltstone that contains sparse interlayered thin sandstone beds (Witkind, 1995). This unit is reported to be up to 610 meters thick and at the site, the formation is observed to form rounded hills with relatively flat plateau tops.

The boundary between Wilberg Flat and the older pediment surface of Danish Bench occurs along a northwest to southwest trending, northeast facing bluff. The bluff is approximately 120 feet high near the center of Section 16. Approximately 10 feet of older pediement gravel overlies Mancos Shale at the top of the bluff. The remainder of the bluff is shale, locally obscured by loose fragments of gravel eroded form the pediment gravel at the top of the bluff.

1.1.3 Permeability

The most pertinent layer separating the migration of water and contaminants from the surface to deeper aquifers is the Blue Gate Member of the Mancos Shale that extends from near surface to approximately 1600 feet below the Emery County Landfill. Results of slug tests performed in two monitor wells drilled into the Blue Gate Member of the Mancos Shale were submitted to the Utah Division of Solid and Hazardous Waste by Bingham Environmental, Inc. The interval tested was from 30 to 110 feet below the existing ground surface. Bingham Environmental reported an average hydraulic conductivity of $5x10^{-5}$ cm/sec. Bingham also reported an average effective porosity of six percent for the shale in this interval.

1.1.4 Hydrology

The Emery County Landfill Site is located in alluvial outwash located several miles from the east slope of the Wasatch Mountains. The terrain consists of small washes, ravines and ridges. These washes may collect local runoff and transport small quantities of water over short distances, but do not appear to transport runoff and flash flood waters/debris flow of significant volume over long distances. This is apparent due to the lack of recent erosion in the washes surrounding the site.

Based on a review of climatological data for the Orangeville area, wet years produce 10 to 13 inches of total annual rainfall. Average annual rainfall at the site over the past nearly 100 years is 8.5 inches. Average annual evapotranspiration at the site is over 45 inches (Utah Climate Center, Utah State University). As shown, the Emery County Landfill site is arid and the majority of the precipitation is soaked up by the surface soils. However, during high intensity precipitation events some brief flash flooding can occur.

1.2 HYDROGEOLOGY AND GROUNDWATER

The only significant aquifer near the Emery County Landfill is the Ferron Sandstone Member of the Mancos Shale. The Ferron Sandstone Member occurs directly below the Blue Gate Member about 1,600 feet below the existing ground surface at the Emery County Landfill location.

The largest source of recharge to the Ferron Sandstone aquifer is subsurface inflow from the west under the Wasatch Plateau. Subsurface inflow near the town of Emery was estimated by Lines and Morrissey at 2.4 cubic feet per second. Most of this moves laterally through crushed zones in the Joes Valley fault system. Lines and Morrissey also stated that "little" water is recharged to the aquifer by precipitation on the outcrop area. Data from Lines and Morrissey suggest that near the Emery County Landfill, the groundwater in the Ferron Sandstone aquifer flows from west to east and infiltration from the surface to the Ferron Sandstone is negligible.

The Blue Gate Member of the Mancos Shale lies directly above the Ferron Sandstone Member and extends to the surface at the Emery County Landfill site as stated previously. The Blue Gate Member is not considered a good aquifer. An aquifer is defined as "a permeable geologic unit that can transmit and store significant quantities of water (Maidment, 1992). The Blue Gate is permeable where fractured, but neither transmits not stores significant quantities of usable water. Based on a single boring completed by Tahoma, a minor amount of perched groundwater was encountered at 140 feet and a more significant water table was encountered at 372 below the existing ground surface. No information on the direction of flow for this groundwater was available, however we anticipate all groundwater flow to be west to east based on the hydrogeologic conditions at the site.

1.3 WATER RIGHTS

Records of the Utah Division of Water Rights have been reviewed to obtain information on points of diversion, water use classifications and depths of wells near the Emery County Landfill. No water rights or points of diversion have been claimed or developed within a one mile radius of the landfill or within Section 16. The points of diversion plots indicating there is nothing located near the landfill are included in Appendix D.

1.4 SURFACE WATERS

There are no permanent impoundments or surface water or perennial streams present within a one mile radius of the site.

1.5 BACKGROUND WATER QUALITY

1.5.1 Surface Water

Because there are no permanent surface water impoundments on or near the site, no surface water quality assessment was performed.

1.5.2 Groundwater

Tahoma recovered water samples at 372 feet from the water table encountered in the Blue Gate Member of the Mancos Shale formation during drilling. These samples were analyzed by the Southern Utah University Water Laboratory. The results of the test indicate a total dissolved solids (TDS) content of 38,400 mg/l.

Published information on the quality of water in the Ferron Sandstone Aquifer was summarized by Lines and Morrissey (1983). Their summary shows that the TDS in groundwater taken from the Ferron Sandstone Member ranged from 500 to more that 50,000 mg/l. The following table summarizes findings from Lines and Morrissey for locations closest to the Emery County Landfill:

Section	Township	Range	Sample Depth (ft)	TDS (mg/l)
25	17 South	7 East	Not Known	14,541
16	17 South	10 East	185-205	3,840
27	20 South	7 East	804-806	21,534
3	20 South	8 East	105	8,120
4	20 South	8 East	120	10,100

1.6 SITE WATER BALANCE

As stated previously in the Hydrology Section of this report, due to the amount of precipitation and evapotranspiration we anticipate runoff from the Emery County Landfill to be minimal. Tahoma used HELP3 computer program to model the site water balance and included the results in the Exemption Request (Appendix D of Tahoma document) found in Appendix E.

2.0 - ENGINEERING REPORT

2.1 LOCATION STANDARDS - EXISTING AND PROPOSED LANDFILL EXPANSION

In addition to the Subtitle D criteria, DSHW has adopted specific location standards. The Utah location standards for Municipal Solid Waste Landfills (MSWLFs), as presented in the Solid Waste Permitting and Management Rules (R315-302), are outlined below.

- Land Use Compatibility (UAC R315-302-1(2)a)
  - Not to be located within 1000 feet of Parks and protected areas
  - Not to be located in an ecologically and scientifically significant area
  - Not to be located on prime or unique farmland
  - Not to be located within ¼ mile of existing dwellings, incompatible or historical structures, unless allowed by local land use planning or zoning
  - Not to be located within 5,000 feet of airport runways
  - Not to be located on archeological sites

- Geology (UAC R315-302-1(2)b)
  - Proximity to a Holocene Fault
  - Considerations for constructing in a seismic impact zone
  - Consideration given to unstable areas

- Surface Water (UAC R315-302-1(2)c)
  - Will not affect public water system
  - Will not affect existing lakes, reservoirs and ponds
  - Cannot be located in a floodplain unless certain criteria are met

- Wetlands (UAC R315-302-1(2)d) Not allowed unless:
  - Alternative location has been denied previously
  - Will not violate state water quality standard or Clean Water Act
  - Will not jeopardize threatened or endangered species
  - Will not cause or contribute to significant degradation of the wetlands

- Groundwater (UAC R315-302-1(2)e)
  - Groundwater/landfill cell separation
  - Sole source aquifer
  - Groundwater quality
  - Source protection areas

The following sections present the Utah MSWLF location standards and discuss the status of the Emery County Landfill's compliance with those requirements.

2.1.1 Land Use Compatibility Requirements

The existing landfill and proposed expansion meets all criteria outlined in UAC R315-302-1(2)(a) as shown below. Documentation of the items listed below is found in Appendix F.

2.1.1.1 Emery County Land Use Compatibility

- The existing facility and proposed expansion is not within 1,000 feet of a national, state or county park, monument or recreation area; designated wilderness or wilderness study area; or wild and scenic river area.

  Source: Gnojek, Tom, U.S. Bureau of Land Management, San Rafael River Resource Area, Price, Utah. See letter from Tahoma Companies dated April 5, 1994.

- The facility is not within an ecologically and scientifically significant natural area, including wildlife management areas and habitat for threatened or endangered species as designated pursuant to the Endangered Species Act of 1982.

  Source: Williams, Robert D., U.S. Fish and Wildlife Service; Salt Lake City, Utah. See letter from Tahoma Companies dated March 31, 1994.

- The facility is not located on farmland classified as "prime" or "unique."

  Source: Jacobsen, Kyle "Jake", Utah Department of Agriculture, Salt Lake City, Utah. See letter from Tahoma Companies dated March 30, 1994.

- The facility is not within one-fourth mile of:

  a) Existing permanent dwellings, residential areas and other incompatible structures such as schools or churches.

  Source: Field investigation by Brett Mickelson of IGES, Inc.

  b) Historic structures or properties listed or eligible to be listed in the State of National Register of Historic Places.

  Source: Dykmann, James L., State of Utah, Utah State Historical Society. See letter from Tahoma Companies dated March 30, 1994 and response letter form the State of Utah dated April 12, 1994.

- The facility is not within 10,000 feet of any airport runway end used by turbojet aircraft or within 5,000 feet of any airport runway used by any piston-type aircraft.

  Source: Rodda, Dave, Aviation Safety Inspector, Federal Aviation Agency, Salt Lake City, Utah. See letter from Tahoma Companies dated April 11, 1994.

- The facility is not within an archaeological site that would violate Section 9-8-204.

  Source: Dykmann, James L., State of Utah, Utah State Historical Society. See letter from Tahoma Companies dated March 30, 1994 and response letter form the State of Utah dated April 12, 1994.

- The facility is not within an area that is at a variance with the Emery County land use plan or zoning requirements.

  Source: Funk, Rex, Emery County Road Department.

2.1.2 Geology and Geotechnical Engineering

2.1.2.1 Geologic Hazards

The Utah State Regulations indicate "No new facility or lateral expansion of an existing facility shall be located in a subsidence area, a dam failure flood area, above an underground mine, above a salt dome, above a salt bed, or on or adjacent to geologic features which could compromise the structural integrity of the facility".

The Emery County Landfill is not adjacent to geologic features that could compromise the structural integrity of the facility. The Emery County Landfill is not in a subsidence area, a dam failure flood area, above an underground salt dome or a salt bed. Minor washes through the site could be subject to debris flow and/or alluvial fan flooding but in general these washes are not large enough to convey water or debris of sufficient quantity to jeopardize the landfill.

2.1.2.2 Fault Areas

A new landfill may not be located within 200 feet of an active (Holocene) fault. There are no known active faults that pass under or within 200 feet of the Emery County Landfill (Witkind, 1995; Hecker, 1993). The site is located approximately 21 miles east of the Joe's Valley fault zone. This fault zone is reported to have been active in Holocene time and to have a 7.5 M_S estimated maximum credible earthquake (Hecker, 1993). The site is also located approximately 38 miles southeast of the Strawberry Valley fault. The Strawberry fault has a reported rupture length of 17.4 miles and a maximum potential magnitude of 7.0. The most recent activity on the Strawberry fault is reported to be early to middle Holocene.

2.1.2.3 Seismic Impact Zone

The EPA and the DSHW define a seismic impact zone as any location with a 10% or greater probability that the maximum horizontal acceleration (MHA) in lithified earth material, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g in 250 years. Tahoma Companies in 1996 indicated there was a 10 percent chance in 250 years that the area could experience horizontal accelerations of 0.20g or greater. Updated mapping by USGS Earthquake Hazards Program – National Seismic Hazard Mapping Project indicates the predicted Maximum Horizontal Acceleration (MHA) at the site is 0.25g. Therefore, the site does lie within a Seismic Impact Zone.

The MHA in lithified earth material is defined in 40 CFR part 258.14 (EPA 1991) as the "maximum expected horizontal acceleration depicted on a seismic hazard map with a 90% or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on site specific seismic risk assessment." This definition was adopted in full by the DSHW. The MHA of 0.2g or greater indicated by Tahoma in 1996 was based on modified USGS maps from "Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico by S.T. Algermissen, D.M. Perkins, P.C. Thenhaus, L.S. Hanson and B.L. Bender (1990)". These maps have recently been superseded by the "United States Geologic Survey's (USGS) Earthquake Hazards Program – National Seismic Hazard Mapping Project". Based on the latitude and longitude of the site, these more recent maps indicate an MHA value of 0.25g for the site. This value is an estimated ground surface acceleration of a "firm rock" site, which is identified as having a shear-wave velocity of 760 m/sec in the top 30 meters and sites with different soil types may amplify or de-amplify this value.

Based on our limited field investigations and our understanding of the soils at the site, it is our opinion the site best fits within the International Building Code (IBC) Site Class B described generally as "rock" having seismic coefficients $F_a = 1.0$ and $F_v = 1.0$.

2.1.2.4 Seismic Impact Zone Analysis

A seismic study was performed by Tahoma Companies, Inc. in May of 1996, and was included as attachment 18 to the initial Permit Application for the Emery County Landfill also dated May 1996. IGES performed a review of Tahoma's seismic study and felt additional analysis should be performed based on the more recent and updated data available pertaining to the waste and soil strength properties and the updated MHA information discussed previously.

Cross-sections of the bottom excavation and final cover were generated and used in modeling static and dynamic stability. The most critical sections of the bottom excavation and final cover were modeled. These sections are presented in Appendix G, Slope Stability.

Municipal Solid Waste (MSW) unit weight and strength properties provided by Tahoma were reviewed. Tahoma had used a value of 50.73 pounds per cubic foot (pcf). Based on the daily

cover and compaction processes currently in use at the Emery County Landfill we estimate the unit weight of the refuse to be approximately 1200 to 1400 pounds per cubic yard, depending on the height of overburden. This corresponds to 44 and 52 pcf, respectively, with an average of 48 pcf. This average value of 48 pcf was used in the analyses.

Based on a large scale direct shear test performed in-situ to measure strength properties of MSW, Withiam et al, 1995, obtained a friction angle of 30 degrees and a cohesion value of 200 psf. Other work by Kavazanjian et al, 1995, suggest a friction angle of 33 degrees for MSW and a shear strength of 500 psf below a normal stress of 627 psf. Based on this information a value of 30 degrees for the angle of internal friction and 150 psf for the cohesion were used to define the strength properties of the Emery County MSW. These parameters compare to MSW strength properties of 20 degrees for the angle of internal friction and 100 pounds per square foot (psf) for cohesion used by Tahoma.

Strength properties of the on-site shale were estimated by Tahoma to have a friction angel of 22 degrees and a cohesion of 3,446 psf as well as a unit weight of 147.5 pcf. No basis for these values, such as laboratory testing, was presented. According to information taken from Introduction to Rock Mechanics by R.E. Goodman, 1980 and reprinted in Principles of Foundation Engineering by Braja M. Das, 1990, an unconfined compressive strength for the on-site shale of 5,000 psf (cohesion = 2,500 psf) appears to be more representative. The soil and MSW properties used in the slope stability analysis are summarized below.

Property	Shale	MSW
Unit Weight (pcf)	145	48
Cohesion (psf)	2,500	150
Internal Friction Angle (deg.)	0	30

Static and pseudo-static analyses of the slope sections were performed using critical sections of the landfill geometry and the soil and waste parameters outlined previously. Results are presented in Appendix G. The static and pseudo-static slope stability analyses were completed using the computer program GSTABL7.

Because the soil profile at the Emery County Landfill site meets the "firm rock" requirements, a site-specific response was not required to propagate the earthquake motion up through the soil

profile to the ground surface. Therefore the maximum horizontal acceleration is considered to be 0.25g as discussed previously. The peak acceleration at the top of the Landfill was estimated using analytical data from Kavazanjian and Matasovic (1994) and Singh and Sun (1995). Based on this data, the peak acceleration at the top of the landfill was estimated at 0.35g. Appropriately, an average acceleration of 0.30g was used in the stability and deformation analysis performed for the waste mass (Repetto et al., 1993).

Hynes and Franklin (1984) performed several Newmark seismic deformation analyses on embankments using 387 strong motion records and 6 artificial accelerograms. The analyses performed considered the yield accelerations of the slope sections evaluated by pseudo-static methods and compared them to the anticipated horizontal embankment accelerations. Based on these analyses performed by Hynes and Franklin, deformations are anticipated to be one foot or less if the yield acceleration is less than or equal to one-half the horizontal acceleration of the waste mass. Therefore, using a horizontal acceleration of 0.15g to obtain a pseudo-static factor of safety of 1.0 or greater indicates satisfactory performance of the waste mass under seismic conditions (deformation less than 1 foot). Based on our analyses, the slopes were evaluated to be stable under static and seismic conditions.

A summary of the static and seismic (pseudo-static and deformation) analyses, based on the change in the waste strength parameters and the new seismic data generated for the soil profile, is presented below. Slope stability runs of the static and dynamic analysis are provided in Appendix G.

Section	Static Factor of Safety	Pseudo-Static Factor of Safety	Yield Acceleration	Deformation (feet)
A (Final Cover – Phases 1 – 4)	3.58	2.15	0.48g	<1
B (Excavation – Phases 5 – 9)	2.54	1.54	0.36g	<1
C (Final Cover – Phases 5 – 9)	3.82	2.25	0.55g	<1

Typical allowable limits in stability analysis are; a minimum factor safety of 1.5 during static conditions, a minimum factor of safety of 1.0 during pseudo-static (seismic) conditions, and a maximum allowable deformation of 1 foot. Based on the results of the analyses performed using the planned geometry of the landfill with 3H:1V excavation slopes in the bottom of the landfill and 4H:1V slopes in the final cover, the stability of the slopes in all areas is above the minimum standards.

2.1.2.5 Unstable Areas

The owner or operator of a landfill must consider several factors when determining whether and area is unstable. Among them are soil conditions, geologic or geomorphic features, and human-made features or events at the surface and in the subsurface.

Soil conditions at the Emery County Landfill site are well suited for construction of a landfill. The site is in a relatively remote area in the foothills of the eastern slope of the Wasatch Mountain Range. The soils underlying the site consist predominantly of Shale Bedrock with some areas containing an overburden layer of silty gravel that is relatively dense and sometimes moderately cemented. The shale is reported to be approximately 1650 feet thick beneath the landfill.

The gravel and shale material underlying the landfill site is relatively incompressible given the height and unit weight of the waste mass. Settlement of the landfill will be limited to consolidation within the waste itself and not the underlying soils. Several inches of consolidation within the waste should be anticipated, however, ten to one (10H to 1V) slopes should be adequate for maintaining adequate drainage.

Geologic features on or near the site would include the minor washes at the site, which could be subject to debris flow and/or alluvial fan flooding. However, as mentioned previously in Section 2.1.2.1 Geologic Hazards, the site is located outside of any washes large enough to convey significant flooding or debris flow and therefore the site does not appear to be associated with any potential geologic hazards.

One known geomorphic feature on site that has been altered by humans is an unnamed intermittent wash that crosses the existing landfill. This wash was channelized in 1983 as part of the original plan for construction and operation of the emery county landfill. An early contract

operator of the landfill inadvertently filled the channelized wash with waste materials during the first years of operation. If left exposed to storm drainage, compact municipal waste deposited in the channelized wash could be eroded and transported downstream by severe storm events. A diversion ditch has been constructed around the north side of the landfill to minimize the potential for water erosion.

2.1.3 Surface Water Requirements

DSHW has adopted Subtitle D location restrictions for floodplains and wetlands. The Emery County Landfill site is not within a floodplain or wetland. All potential run-on water from the drainage will be diverted around the landfill site by shallow ditches or low berms.

No permanent impoundments of surface water or perennial streams are present within a one mile radius of the landfill.

2.1.4 Wetlands Requirements

The Emery County Landfill is not situated in a designated wetlands area.

2.1.5 Groundwater Requirements

DSHW location restrictions with respect to groundwater protection include the following:

- No new facility shall be located at a site where the bottom of the lowest liner is less than 5 feet above historical high level of groundwater in the uppermost aquifer.
- No new facility shall be located over a sole source aquifer as designated in 40 CFR 149.
- No new facility shall be located over groundwater classified as IB under Section R317-6-3.3 (an irreplaceable aquifer).
- A new facility located above any aquifer containing groundwater which has a total dissolved solids (TDSs) content below 1,000 milligrams per liter (mg/l) and does not exceed applicable groundwater quality standards for any contaminant is permitted only where the depth to groundwater is greater than 100 feet. For a TDS content between 1,000 and 3,000 mg/l, the separation must be 50 feet or greater. These

separation distance requirements are waived if the landfill is constructed with a composite liner.

- No new facility shall be located in designated drinking water source protection areas or, if no such protection area is designated, within a distance to existing drinking water wells or springs for public water supplies of 250-day groundwater travel time

2.1.5.1 Emery County Landfill Groundwater

Emery County Landfill complies with the requirements as outlined. The landfill bottom is not within five feet of the historic high level of groundwater. The landfill is not located over a sole source aquifer. The landfill is not located over an irreplaceable aquifer. Groundwater depth is greater than 100 feet. The landfill is not located in a designated drinking water source protection area or near springs or public drinking water wells.

No free groundwater is present within the overburden gravels at the site. In addition, the shale underlying the site is not known to store usable quantities of groundwater. As indicated previously, no water rights or points of diversion have been claimed or developed within a one mile radius of the landfill or within Section 16. Based on this information, the landfill meets the requirements of the groundwater protection location restrictions.

2.2 FACILITY LIFE

The estimated facility life is based on current and projected waste streams, and density estimates of the compacted waste material. The estimated life also takes into account the incorporation of recycling, composting and other programs that might affect the waste stream.

The total volume available at the Emery County Landfill is estimated to be approximately 672,000 cubic yards. Typical use of cover soils will result in approximately 20% of the landfill volume being filled with soil. The reduction in airspace due to cover soils leaves approximately 537,000 cubic yards of airspace for MSW disposal use. The most recent scale records indicate that the landfill accepts approximately 37 tons per day of waste. The average density of the waste is approximately 1,200 pounds per cubic yard, resulting in a landfill life of approximately 17 years.

Based on these estimates, the following table shows the capacity and projected life span of each of the nine phases currently planned for development.

Landfill Area	Landfill Phase	Phase Volume (cubic yards)	Waste Capacity (cubic yards)	Projected Life Span
North Mass Fill Area	1	64,019	51,215	Filled
	2	64,041	51,233	Filled
	3	64,027	55,222	Filled
	4	159,360	127,488	Dec. 2008
Southeast Excavated Area	5	38,289	30,631	April 2010
	6	32,280	25,824	June 2011
	7	24,594	19,675	April 2012
Southeast Mass Fill Area	8	123,558	98,846	Sept.2016
	9	102,155	81,724	April 2020
TOTALS	**All Phases**	**672,323**	**537,858**	

2.3 CELL DESIGN

The growth of the Emery County Landfill has been broken into nine phases. The Permit Drawings show the nine Phases of the Emery County Landfill proposed growth plan. The nine Phases of the landfill are as described in Sections 3.1.1.1 through 3.1.1.3 of Part II.

2.3.1 Liner

Due to the great distance to groundwater and low permeability of the site soils, arid climate, and high evaporation rate, the Emery County Landfill has been exempted from synthetic liner requirements. With the continued approval of the Executive Secretary, the proposed landfill expansion will not construct a synthetic liner system on the new phases. IGES has excavated and logged additional test pits at the Emery County Landfill. Lab test data confirms previous near surface exploration work at the site performed by Tahoma Inc. IGES lab data is presented in Appendix H.

2.3.2 Fill Method

Wastes are dumped at the toe of the work face and spread up the slope in one to two foot layers, keeping the working slope at a maximum three to one (horizontal to vertical).

Work face dimensions are kept narrow enough to minimize blowing litter and reduce the amount of soil needed for daily cover. However, dimensions should be wide enough to accommodate vehicles bringing garbage into the landfill safely. The Solid Waste Association of North America (SWANA) recommends that the width of the work face be no less than three times the width of the compactor blade.

Typically the compactor is operated with the blade facing uphill. Equipment operations across the slope are avoided to minimize the potential of equipment tipping over. In addition to safety an uphill operation provides the following benefits:

- Minimizes blowing litter problems.
- Increases equipment compactive effectiveness.
- Increased visibility for waste placement and compaction.
- More uniform waste distribution.

Grade stakes are used when necessary to control cell height and top surface grade. The top of the surface grade ranges from 2 to 5 percent, and the cell height ranges from 8 to 10 feet.

Wastes are compacted by making three to five passes up and down the slope. Compaction reduces litter, differential settlement, and the quantities of cover soil needed. Compaction also extends the life of the site, reduces unit costs, and leaves fewer voids to help reduce vector problems. Care is taken that no holes are left in the compacted waste. Voids are filled with additional waste as they develop.

2.3.3 Daily, Intermediate and Final Cover

2.3.3.1 Daily and Intermediate Cover

Daily cover typically comes from the borrow area northwest of the landfill cells. The borrow source is about a 100 foot high ridge that protrudes and terminates on the landfill property.

The ridge is primarily made up of Mancos shale material with some overburden gravels. The material is placed approximately six inches thick. The material is used to retard infiltration of surface water and discourage vectors.

Intermediate cover is required to be placed when portions of a Class I unit which will be idle for more than 30 days. Currently intermediate cover has been placed on Phases 1, 2 and 3, which have been filled. The source of intermediate cover is the same as the daily cover. The intermediate cover is to minimize the potential for water infiltration, blowing waste and vector problems. Intermediate cover will consists of at least 12 inches of site soils.

Compacted intermediate cover will remain exposed to atmospheric conditions for no more than three years before being covered with additional waste or final cover soils. Any areas of the landfill with intermediate cover that may be exposed to the atmosphere for more than three years will receive an additional 12 inches of cover soil. Areas with intermediate cover will be inspected for erosion and/or settlement quarterly. Damaged areas of the intermediate cover will be regraded and recompacted when necessary to restore the intermediate cover.

2.3.3.2 Final Cover

Emery County Landfill is proposing to use an alternative earthen final cover. The cover will consist of a monolithic barrier constructed from the borrow sources discussed in this report. The cover is designed to maximize runoff and then store remnant precipitation until it can be lost to evaporation and transpiration (evapotranspiration), thus providing a barrier to infiltration into the landfill.

The Emery County Landfill site is ideal for this type of cover because transpiration is so much greater than precipitation throughout the year. Based on climatological data obtained from the Utah Climate Center at Utah State University, the area receives an average of 8.4 inches of precipitation (rain and snow) each year while an average of 45.14 inches of evapotranspiration occurs. These values are based on daily climatological data from 1948 to the present.

In order to evaluate the storage/loss potential of the cover soil at the site, two sets of information needed to be assessed. First, the soil properties of the borrow material to be used as cover had to be evaluated, and second the worst case climate data had to be established in

regards to potential infiltration into the landfill. Using these two parameters, the required thickness of the cover soil could then be established.

In order to evaluate the properties of the cover soil, IGES obtained seven samples of material from various locations throughout the proposed borrow sources. Of these seven samples, five were tested to evaluate capillary-moisture relationships, three were tested to evaluate remolded permeability and all seven samples had moisture-density relationships (proctors) and plastic limit tests completed.

The five capillary-moisture relationship tests were performed to evaluate the storage potential of the proposed cover soil. These tests evaluate the moisture retained in the soil under various suction pressures that are representative of conditions produced by evaporation and transpiration. The storage capacity of the soil is defined as the difference between the volumetric moisture content at field capacity and the volumetric moisture content at wilting point. Where the field capacity of the soil is taken as the volumetric moisture content at a suction pressure of 33 kPa and the wilting point is taken as the volumetric moisture content at a suction pressure of 1,500 kPa. The results of the tests indicate the proposed cover soils are relatively consistent throughout the borrow sources. The following table summarizes the capillary-moisture test results.

Location	Field Capacity (% by volume)	Wilting Point (% by volume)	Storage Capacity (% by volume)
Cover Sample No. 1 (borrow slope)	35.5	17.0	18.5
Borrow No. 1 (southwest borrow slope)	37.8	17.9	19.9
Borrow No. 2 (existing stockpile)	34.4	19.6	17.5
Borrow No. 3 (southcentral borrow slope)	37.2	19.3	17.9
Borrow No. 4 (excavation for cells 5 -7)	30.5	13.2	17.3
AVERAGE	35.1	16.9	18.2

The laboratory back-pressure permeability tests were conducted for general information pertaining to the inherent permeability of the site soils. Each of the permeability samples were remolded to 85 percent of ASTM D698 (Standard Proctor) at approximately 6 percent

moisture, which represents very dry and loosely compacted field conditions. Under these conditions, the proposed material showed a laboratory permeability ranging from $2.4x10^{-6}$ to $7.9x10^{-8}$ cm/sec. The results of the tests are summarized in the following table:

Sample*	Maximum Dry Density (lb/cu. ft.)	Optimum Moisture (percent by weight)	Back-Pressure Permeability (cm/sec)
Cover No. 1	125.4	11.5	$7.9x10^{-8}$
Liner No. 1	122	12	$2.38x10^{-6}$
Liner No. 2	121.5	12	$1.29x10^{-7}$

* All samples were tested at 85% of the listed MDD and at 6% moisture content by weight

In addition to these test results listed, liquid and plastic limit tests were performed, gradation analyses were performed and additional proctors were performed. All of the laboratory data is summarized in Appendix H.

In order to establish the worst case climate data for the site and evaluate the required alternative cover soil thickness, the daily rainfall totals for an entire year had to be evaluated in a spreadsheet. The spreadsheet considers the available storage capacity of the cover soils based on the capillary-moisture data and then compares that to the daily evapotranspiration and daily rainfall recorded for that year. For a given thickness of cover material there is a maximum available storage, if the storage capacity of the cover soil is exceeded then the spreadsheet indicates infiltration through the cover layer. Within the spreadsheet, the evapotranspiration rate is also reduced by 40 percent to account for the difference in free-water surface evaporation and the evaporation from the soil particles. This reduction also accounts for the limiting factors pertaining to the plants ability to transpire moisture from the soil.

Each year of available data (1948 to present) was analyzed to ascertain a critical year where there was the most potential for infiltration through a given soil cover thickness. Based on our analysis the year 1980 appeared to represent the worst case of the years on record. 1980 did not have the highest yearly rainfall total, but it did have the most consecutively high precipitation amounts. With high consecutive precipitation amounts, the available storage capacity of the cover soil is not allowed to recover as it would when there are dry days in between events that would allow evapotranspiration to occur. Therefore the antecedent moisture accumulates and is pushed deeper until infiltration occurs.

Using the worst case climatological data, represented by the year 1980, three years in a row, it was established that 24-inches of cover soil was adequate to prevent infiltration into the landfill. Considering desiccation cracking, root growth, rodent burrows and other surface anomalies we propose a minimum cover thickness of 30-inches. The results of the alternative cover analysis are shown in Appendix I.

Due to the potential capillary rise of the cover soils being as high as 25' (10 times the thickness of the final cover); the entire thickness of the final cover is exposed to evapotranspiration capillary forces.

2.3.3.3 Borrow Sources

As indicated previously, borrow sources for daily, intermediate and final cover comes primarily from the large ridge located northwest of the landfill cells that extends onto the landfill property. The ridge consists mainly of Mancos shale that can be excavated using conventional equipment. When exposed to the elements the Mancos shale quickly weathers into a residual clay material. It is estimated there is sufficient material within this ridge to meet daily, intermediate and final cover requirements. Samples of this material source were obtained and analyzed as alternative final cover material for Phases 1, 2 and 3.

2.3.3.4 Elevations of Liner and Final Cover

As illustrated on the Permit Drawings that are included with this permit application, the landfill will not be constructed with a synthetic liner. The bottom of the landfill for Phases 5 through 9 will be relatively flat. The lowest elevation of the landfill in Phases 5 through 9 is planned to be constructed at 5931 feet above mean sea level (Drawing 4).

The maximum planned elevation for the final cover in Phases 1 through 4 is planned to be 6033 feet above mean sea level. For Phases 5 through 9 the final elevation is planned to be 6000 feet. Final cover side slopes are planned to be 4:1 (horizontal to vertical) with the top surface at 10:1.

2.3.4 Equipment Requirements and Availability

The following equipment is currently on site for routine operation of the landfill:

- 1994 Caterpillar 966F Wheel Loader

- 1972 Caterpillar D6C Dozer
- 826C Caterpillar Compactor
- 1999 Volvo A35C Articulated Haul Truck
- 1980 Mack Water Truck
- 1989 Ford F450 Flat Bed Truck

The Emery County Road Department will provide and operate other equipment as needed for construction activities. This equipment may consist of loaders, compactors, water trucks, excavators, rock crushers, etc. All landfill personnel are provided with two way radios and are in communication with each other and the county road department shop by telephone.

2.4 MONITORING SYSTEM DESIGN - EXISTING AND PROPOSED LANDFILL EXPANSION

2.4.1 Groundwater

Emery County Landfill does not plan to monitor groundwater. Tahoma Companies, Inc. applied for a waiver from groundwater monitoring. The waiver was tentatively granted in a letter dated February 29, 1996 from DSHW to Emery County Commissioner Bevan Wilson. As a result groundwater monitoring wells will not be installed and monitoring will not be performed as part of the regular monitoring program.

During the public comment period of the permitting process, the Division published a Draft Statement of Basis for granting the exemption from groundwater monitoring and from constructing the landfill with liners and a leachate collection system. No changes to the permit or the Draft Statement of Basis were required. Accordingly, the operating permit for the landfill was granted without requiring groundwater monitoring or requiring construction of the landfill with liners and a leachate collection system

2.4.2 Leachate Collection and Treatment System

The Emery County Landfill is exempt from leachate collection and treatment requirements under UAC R315-303-4(3)(c). With the approval of the Executive Secretary, the Landfill will not construct leachate collection and treatment system.

2.4.3 Landfill Gas

This facility is monitored for methane gas on a quarterly basis. Concentrations of methane gas are measured with a hand-held gas monitor.

Gas readings will be recorded at each end of the active cell, the office and shop, the fuel tanks, and other places at random. Readings will be recorded on the "Gas Log" sheet and kept on file in the scale house office. Gas monitoring activities at the Emery County Landfill are performed by the local health department (Southeastern Utah Health).

2.5 DESIGN AND LOCATION OF RUN-ON/RUN-OFF CONTROL SYSTEMS

The run-on and run-off information provided is based on a drainage study for the Emery County Landfill prepared by Mr. Ben Lamoreaux, P.E. This report was previously submitted under separate cover. The drainage study is included as Appendix K.

2.5.1 Run-On from a 24-Hour, 25-Year Storm

Run-on into the Landfill from the north has been diverted by construction of a ditch along the northern boundary. This ditch will deflect all potential run-on from the north of the facility into natural drainages east of the Emery County Landfill.

Potential run-on from areas northwest of the existing fenced landfill is deflected by topography into a deeply incised (approximately 15 feet deep) northwest to southeast trending channel that runs parallel to the Landfill's southerly fence, approximately 500 feet southwest of the fence line.

Existing drainages in the unused, westernmost, portion of the Landfill capture any sheetflow entering the Landfill from the west. Water from these existing drainages is carried out of the Landfill under the landfill access road in a 36-inch diameter corrugated metal pipe culvert.

2.5.2 Run-Off from a 24-Hour, 25-Year Storm

Run-off from active portions of the Landfill will be directed into the excavation area for Phases 5 through 9 until the excavation is used as a landfill unit. The excavation is large enough to retain all potential run-off from the 30-acres of the active landfill site that drain

toward it. The available volume of the excavation for Phases 5 through 9 is large enough to retain many times the average annual precipitation falling on the active landfill site disregarding evaporation and infiltration. Run-off from the remaining, unused, 10 acres of the site are downhill and will not contact waste and will be allowed to leave the landfill site in existing natural drainages without collection or treatment.

After final cover has been placed, run-off from the covered cells will be directed by ditches along the eastern and southern perimeters of the landfill site into a natural drainage that exits the Landfill at the southeast corner. This run-off will not contact waste and will be allowed to leave the Landfill site without collection or treatment. The proposed locations and typical cross sections of all run-off control structures are shown on the Permit Drawings.

2.6 CLOSURE PLAN - EXISTING AND PROPOSED LANDFILL EXPANSION

2.6.1 Closure Schedule

Closure will occur incrementally. Each phase of the Landfill will be closed once it has been filled to design capacity, unless additional phases will be constructed over them, as in the case of Phases 5, 6 and 7. Installation of the final cover, landscaping and contouring will proceed as follows:

1) Emery County will notify the Executive Secretary of the intent to implement closure in part, 60 days prior to the projected final receipt of waste at the uppermost landfill phase.

2) Emery County will begin closure of the Landfill phases within 30 days after receipt of the final volume waste. Closure activities will be completed within 180 days from their starting time, unless an extension is granted by the Executive Secretary.

3) The Landfill capacity and projected life broken down by phase are presented in the following summary table:

Landfill Area	Landfill Phase	Phase Volume (cubic yards)	Waste Capacity (cubic yards)	Projected Life Span
North Mass Fill	1	64,019	51,215	Filled

Area	2	64,041	51,233	Filled
	3	64,027	55,222	Filled
	4	159,360	127,488	Dec. 2008
Southeast Excavated Area	5	38,289	30,631	April 2010
	6	32,280	25,824	June 2011
	7	24,594	19,675	April 2012
Southeast Mass Fill Area	8	123,558	98,846	Sept.2016
	9	102,155	81,724	April 2020
TOTALS	**All Phases**	**672,323**	**537,858**	

4) New areas of the Landfill will be developed as the current design approaches capacity.

Once the Emery County Landfill is full, or after a decision is made to close the facility, the operator will sell stockpiled recyclable materials to an independent contractor(s), and cover all remaining waste. Any excess borrow material previously excavated landfill units and/or disposal pits will then be graded level or convex upward surface. Slopes on convex upward surfaces will be graded at 4:1 (horizontal to vertical) to eliminate potential ponding. The areas will be planted with the same seed mixture used to vegetate the final cover.

When closure is completed, Emery County shall submit the following to the Executive Secretary:

- As-built unit closure plan sheet(s) signed by a licensed professional engineer registered in the state of Utah.
- Certification by Emery County and a licensed professional engineer in the state of Utah that the site has been closed in accordance with the approved closure plan.
- Closure plans and certification of closure will be submitted with the closure of each of the two disposal units (North Mass Fill Area and the Southeast Mass Fill Area).

2.6.2 Design of Final Cover

Emery County Landfill is proposing to use an alternative earthen final cover. The cover will consist of a monolithic barrier constructed from the borrow sources discussed in this report. The cover will be designed to maximize runoff and store remnant precipitation until it can be lost to evaporation and transpiration (evapotranspiration), thus providing a barrier to

infiltration. The final cover design for the Landfill has been previously discussed in Section 2.3.3.2.

2.6.3 Final Inspection

The DSHW will be invited to inspect the final grading of the Landfill. After approval of the final grading, a schedule will be established for vegetation. Agency personnel will then be invited to return to inspect the success of the erosion control system after one year.

2.7 POST-CLOSURE CARE PLAN - EXISTING AND PROPOSED LANDFILL EXPANSION

2.7.1 Site Monitoring

Utah State regulations stipulate that Emery County shall provide post-closure activities for continued facility maintenance and monitoring of land and gases for 30 years. The Executive Secretary may continue monitoring (even longer that the 30 year post-closure period) if it is felt more time is needed for the facility to become stabilized and/or to protect human health and the environment.

Minor quantities of landfill gases are expected to be generated at the Emery County Landfill after closure. Landfill settlement will be monitored and surface depressions in the cover repaired if consolidation of the wastes occur to a substantial degree.

2.7.1.1 Gas Monitoring

In the event of closure of the Landfill monitoring shall be conducted on a quarterly basis. The frequency of monitoring may be reduced only after a successful demonstration to the Executive Secretary that the closed landfill has stabilized.

2.7.1.2 Land Monitoring

Post-closure monitoring will be conducted quarterly throughout the closure and post-closure period. Landfill topography shall be visually checked for depressions that could results in ponding or rapid erosion. Irregularities in the surface of the final cover will be regraded and revegetated as needed to protect the surface from erosion and to eliminate ponding.

Side slopes will be maintained or reestablished with a maximum gradient of 4:1 and the top slopes will be maintained at no less than 10:1 to prevent ponding. The frequency of monitoring may be reduced only after a successful demonstration to the Executive Secretary that the closed landfill has stabilized.

Unscheduled monitoring of the landfill surfaces will be conducted after a 25-year storm event.

2.7.1.3 Groundwater Monitoring

Emery County Landfill does not plan to monitor groundwater. Tahoma Companies, Inc. applied for a waiver from groundwater monitoring. The waiver was tentatively granted in a letter dated February 29, 1996 from DSHW to Emery County Commissioner Bevan Wilson. As a result groundwater monitoring wells will not be installed and monitoring will not be performed as part of the post-closure monitoring program.

During the public comment period of the permitting process, the Division published a Draft Statement of Basis for granting the exemption from groundwater monitoring and from constructing the landfill with liners and a leachate collection system. No changes to the permit or the Draft Statement of Basis were required. Accordingly, the operating permit for the landfill was granted without requiring groundwater monitoring or requiring construction of the landfill with liners and a leachate collection system

2.7.1.4 Surface Water Monitoring

During post-closure, run-off from the covered cells will be directed by ditches along the eastern and southern perimeters of the landfill site into a natural drainage that exits the Landfill at the southeast corner. The ditches will be inspected quarterly through the post-closure period. Repairs will be completed as part of the maintenance activities.

2.7.2 Changes to Record of Title, Land Use and Zoning

The County Recorder will be provided plats and a statement of fact concerning the location of any disposal site no later than 60 days after certification of closure, as per Section 302-2(6) of the Rules. If necessary, the closed Landfill will be rezoned to conform with current Emery County zoning regulations after final closure. A description of the Landfill history and filled

areas will be permanently appended to the record of title. Land use restrictions will be assigned to the site in compliance with existing regulations for closed landfills at the time of closure.

2.7.3 Maintenance

Post-closure maintenance activities will be designed and implemented under the direction of a licensed professional engineer in response to results of monitoring. Design decisions will be made after the first post-closure quarterly inspection and implemented within 30 days after identification of maintenance issues. Results of post-closure maintenance shall be reported to the executive secretary by a professional engineer licensed in the state of Utah.

Because of the arid climate in Emery County, maintenance of final covers and run-on/run-off systems should be minimal. Final cover and control structures will be inspected quarterly as outlined in the post-closure plan.
Run-on/run-off control structures and final covers could be damaged by and unusually intense storm. Consequently, an unscheduled inspection will be required after any occurrence of a 25-year storm event within a five-mile radius of the site. If the post-storm inspection discloses damage, it will be appraised by a licensed engineer. The engineer will solicit bids if necessary and supervise repairs completed by the Emery County Road Department or a licensed contractor. Funds for payment for the repair work will be disbursed from the Financial Assurance Plan after approval by the Executive Secretary.

2.7.4 Post-Closure Contacts

The Emery County Board of Commissioners should be contacted concerning the Landfill during the post-closure period at: P.O. Box 629 Castle Dale, Utah 84513 or by telephone (801) 381-2119.

2.8 POST-CLOSURE LAND USE - EXISTING AND PROPOSED LANDFILL EXPANSION

Emery County Landfill will complete a post-closure land use plan to be implemented at the Landfill within 5 years prior to the end of the landfill's life. Emery County will select an end use for the landfill consistent with good landfilling practices and will be in accordance with zoning

and other regulations in force at the time. The final land use selected for the Landfill will be based upon maintaining a functional landfill cover.

Typical end uses range from recycling operations (which complement existing operations) to recreational activities. Since the closure of the site is several years away and additional growth may occur, it is not practical to develop land use plans consistent with surrounding land uses that are not fully known.

2.9 FINANCIAL ASSURANCE

Cost estimates for closure and post-closure care were prepared using the worksheet found in Appendix J. Closure and post-closure costs were obtained from similar costs from other landfills in the State

2.9.1 Closure Costs

The closure cost estimates were based on the cost to close the largest area of the disposal facility or unit requiring a final cover, including the cost of obtaining, moving and placing the cover material, final grading, placing topsoil, fertilizing and seeding.

The Emery County Landfill will be closed incrementally. The largest unit requiring final cover material is Phase 1. Unit costs for applying final cover were provided to the Emery County Road Department by Johansen and Tuttle Engineering, Inc.

2.9.2 Post Closure Care Costs

The post-closure estimate must be the cost for completing care reasonably expected during the 30-year post-closure period. These tasks include site inspections, maintenance, and record keeping.

2.9.3 Financial Assurance Mechanism

The amount required for financial assurance (for the largest open area) is summarized in the table below:

Total Financial Assurance Costs

Engineering Total:	$15,720
Construction Total:	$104,274
10 % Contingency:	$11,999
SUBTOTAL:	**$131,993**
TOTAL CLOSURE COSTS:	**$131,993**
Post-Closure Total:	$87,780
TOTAL FINANCIAL ASSURANCE:	**$219,773**

3.0 - REFERENCES

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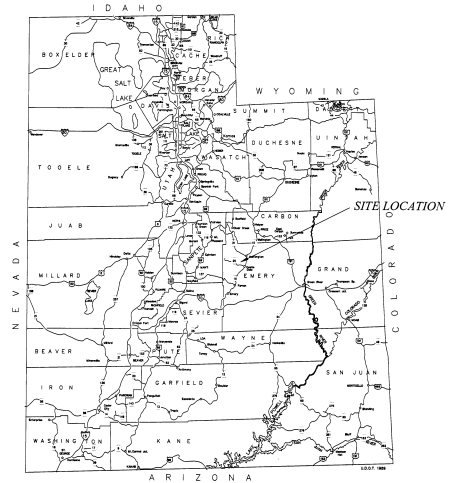
EMERY COUNTY LANDFILL
EMERY COUNTY, UTAH

LIST OF DRAWINGS



QUADRANGLE LOCATION MAP
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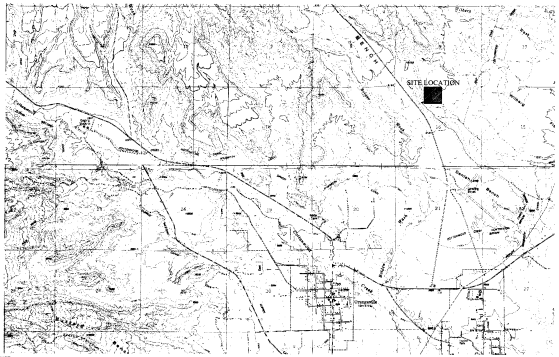
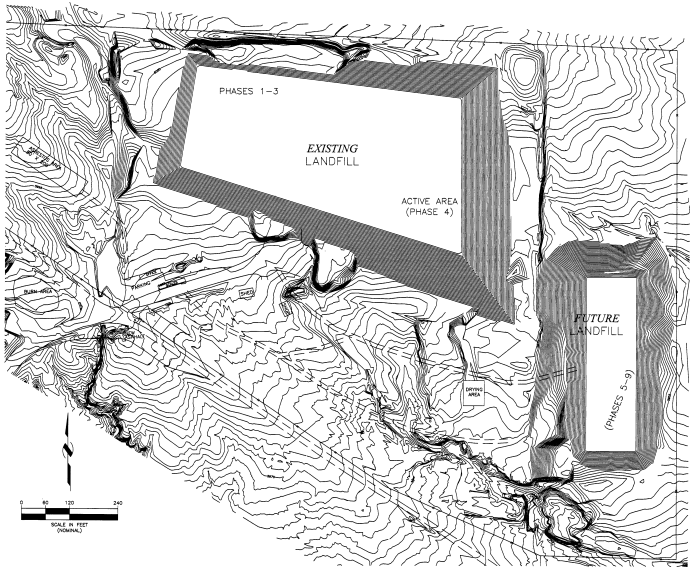


VICINITY MAP



SITE MAP

Emery County
P.O. Box 889
Castle Dale, Utah
(435) 381-5450

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IGES
ideas for a changing world

182 South 600 East, Suite 206
Salt Lake City, Utah, 84102
(801)521-1800 Fax: (801)521-2800

MARK	DATE	DESCRIPTION
	6/2/03	PERMIT
	5/14/03	DRAFT

ISSUE:

PROJECT NO.:	00450-001
CAD DWG FILE:	00450-001
DRAWN BY:	JO
DESIGNED BY:	BDM
CHECKED BY:	BDM
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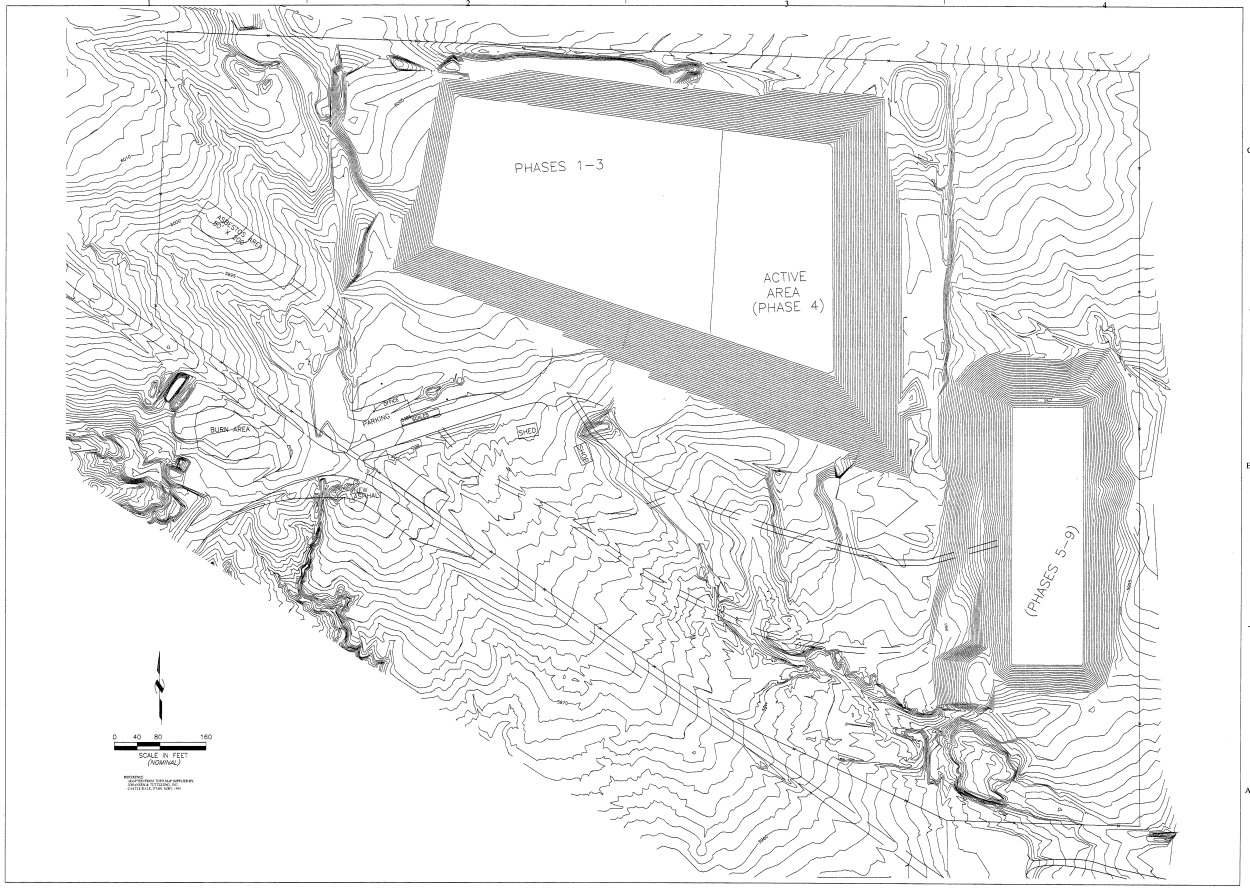
SHEET TITLE

EMERY COUNTY LANDFILL

TITLE SHEET & MISC. MAPS



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PROJECT NO.:	00450-001
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DESIGNED BY:	BDM
CHECKED BY:	BDM
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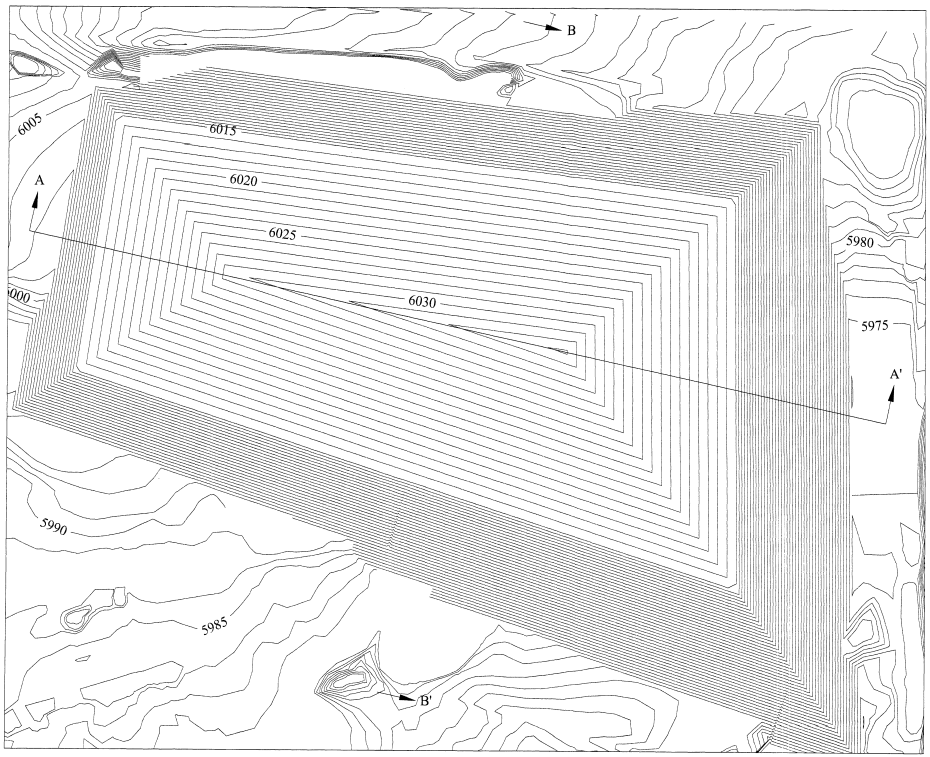
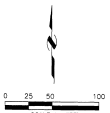
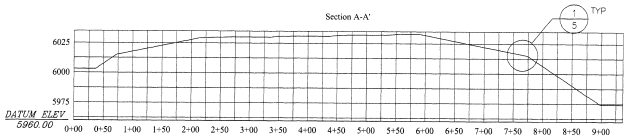
EMERY COUNTY LANDFILL

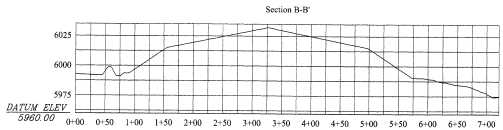
GENERAL ARRANGEMENT

2









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	5/14/03	DRAFT

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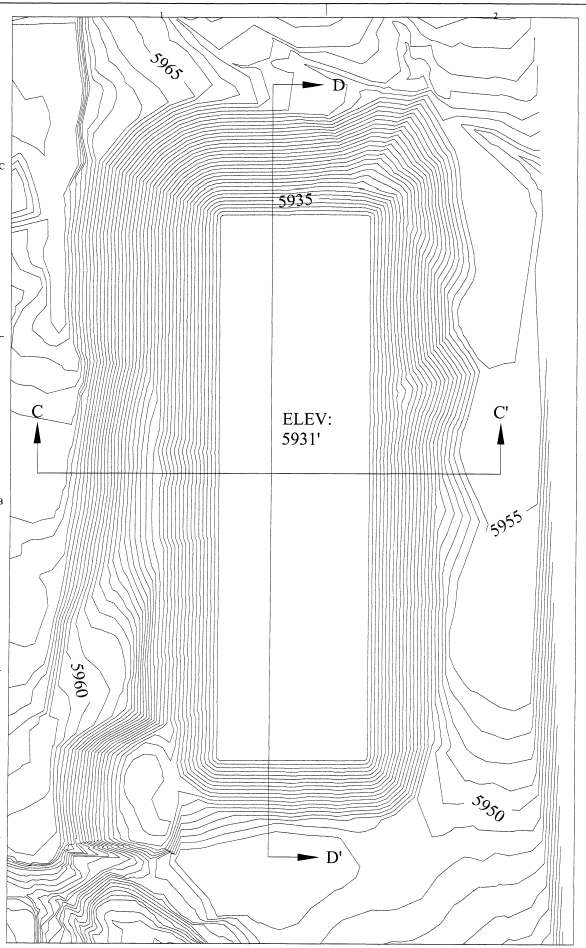
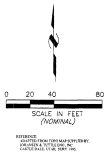
EMERY COUNTY LANDFILL

PHASES 1-4





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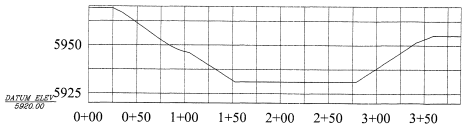

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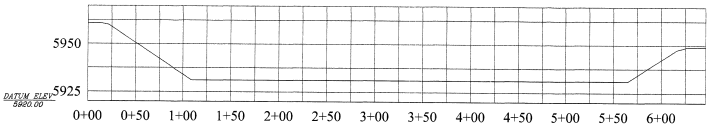

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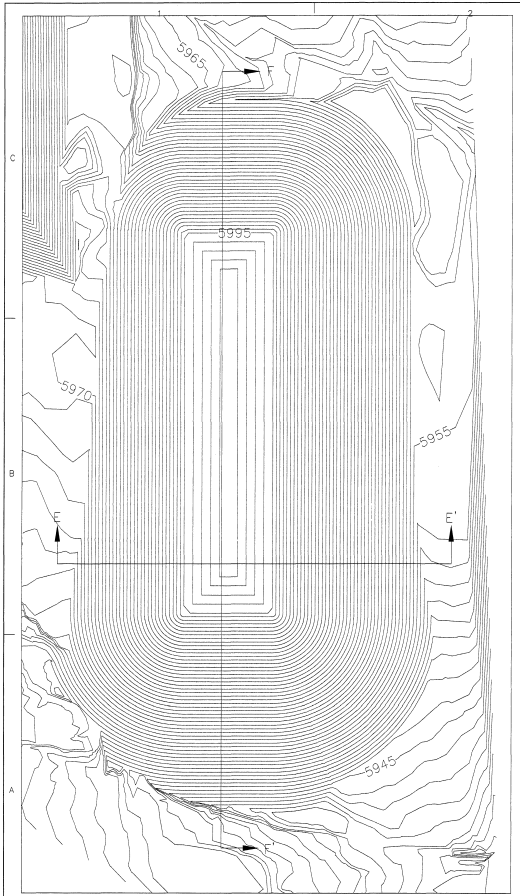
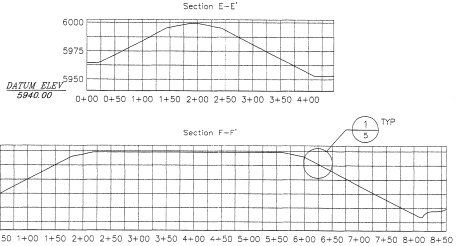
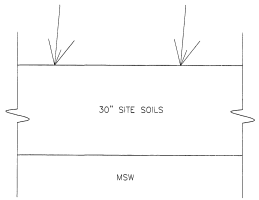
SHEET TITLE

EMERY COUNTY LANDFILL
PHASES
5-7

4







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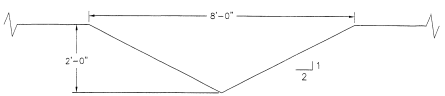

DETAIL 2/2 DRAINAGE DITCH

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	5/14/03	DRAFT

ISSUE:

PROJECT NO.:	00450-001
CAD DWG FILE:	Phase 8.dwg
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	BDM
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SHEET TITLE

EMERY COUNTY LANDFILL

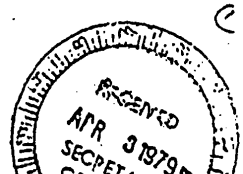
PHASE 8 & 9 & DETAILS

5

APPENDIX B

No. 18702

To All to Whom These Presents Shall Come Greeting:



WHEREAS, EMERY COUNTY

CASTLE DALE

of the County of EMERY State of UTAH heretofore purchased from the State of Utah, the lands hereinafter described, pursuant to the laws of said State in such case made and provided,

AND WHEREAS, the said EMERY COUNTY

ha...S paid for said lands, pursuant to the conditions of said sale, and the laws of the State duly enacted in relation thereto, the sum of Thirty-two Thousand and no/100 ($32,000.00) Dollars, and all legal interest thereon accrued, as fully appears by the certificate of the proper officer, now on file in the office of the Secretary of State of the State of Utah;

NOW THEREFORE, I SCOTT M. MATHESON, Governor, in consideration of the premises, and by virtue of the power and authority vested in me by the laws of the State of Utah, in such case made and provided, do issue this PATENT, in the name and by the authority of the State of Utah, hereby granting and confirming unto the said

EMERY COUNTY

and to its ...ssors and assigns forever, the following tract or parcel of land, situated in the County of EMERY State aforesaid, to-wit: Southwest Quarter (SW¼), West Half (W½) of the Northwest Quarter (NW¼), Northeast Quarter (NE¼) of the Northwest Quarter (NW¼), Northwest Quarter (NW¼) of the Northeast Quarter (NE¼) of Section Sixteen (16), Township Eighteen (18) South, Range Eight (8) East, Salt Lake Base and Meridian.

Subject to all existing rights of record. Subject to Utah Code Annotated, 1953, 65-1-29 which states "..... The estate of the purchaser in lands so sold shall endure only for so long as the lands are used for a public purpose and, on failure of such use, shall revert to the State of Utah.....".

ITEM B

57

(Reserving to the State of Utah all coal and other minerals in the above lands, and to it, or persons authorized by it, the right to prospect for, mine and remove coal and other minerals from the same, upon compliance with the conditions and subject to the limitations of Title 65, Chapter 1, Utah Code Annotated 1953, and amendments thereto.)

Right of way for canals, ditches, tunnels, telephone and transmission lines constructed by authority of the United States, as reserved, U. S. Act. Aug. 30th, 1890 [26 Stat. 391]; 43 - 2 - 3 Utah Code Annotated 1953.

containing Three Hundred and Twenty and no/100 (320.00) acres according to the said certificate.

TO HAVE AND TO HOLD the above described and granted premises unto the said EMERY COUNTY and to its heirs and assigns forever, subject to any easement or right of way of the public, to use all such highways as may have been established according to law, over the same or any part thereof, and subject also to all rights of way for ditches, tunnels, and telephone and transmission lines that may have been constructed by authority of the United States.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused the great seal of the State of Utah to be hereunto affixed. Done at Salt Lake City, this 26th day of MARCH in the year of our Lord, one thousand nine hundred and Seventy-Nine, and of the independence of the United States of America the two hundred and 203, and in the 84 year of the State of Utah.

By the Governor:

Lieutenant Governor — Secretary of State

Director, Division of State Lands

Recorded Patent Book 37 Page 32

Certificate of Sale No. 24180

STATE OF UTAH } SS
COUNTY OF EMERY }
FILED AND RECORDED FOR
Mar 25 4 55 PM '79
IN BOOK 107 PAGE 57-58
COUNTY RECORDER

283787

58

ITEM B

#57252

AUDITOR'S TAX DEED

TO EMERY COUNTY

THIS DEED, made the First day of April, A. D. 19 37, between Emery County, State of Utah, by Hector L. Peterson as County Clerk and ex-Officio Auditor of Emery County, State of Utah, party of the first part, and Emery County, State of Utah, party of the second part, WITNESSETH:

THAT WHEREAS, as shown by certificate of sale made by Ray Cox as County Treasurer of Emery County, aforesaid, dated Dec. 30 and hereinafter referred to, in the year 1932 the property hereinafter described, having been duly assessed, according to law, there were duly levied for said year, State, State School, State High School, State Road, State Bounty, Emery County, Emery County School District, City, Town, and taxes, in the aggregate amount of Eighteen and 58/100---------- DOLLARS, against Belle Harris Haynes on the real property hereinafter particularly described, situate in Emery County, Utah, and

WHEREAS, on the 30th day of December, 1932, after due notice of assessment for said year, and notice of time and place for the payment of said taxes and the time when they would become delinquent, and opportunity to pay same having been given to said Belle Harris Haynes in the manner prescribed by law, and the said taxes, being then past due, wholly unpaid and delinquent, the said Treasurer sold to Emery County, subject to redemption in the manner provided by law, the property hereinafter described, for the delinquent taxes for which said property is liable, assessed in the name of Belle Harris Haynes as owner for the year 1932, and costs of sale, together with the penalty provided by law, in the aggregate sum of Nineteen and 64/100---------- DOLLARS; and pursuant to law, the said Treasurer executed a certificate of sale covering said property, dated December 30, 1932, to Emery County, and delivered same to Herbert Moffitt as County Clerk and ex-Officio Auditor of Emery County, State of Utah, and

WHEREAS, four years have elapsed since the date of said sale and said property has not been redeemed therefrom,

NOW THEREFORE, the said party of the first part, as County Clerk and ex-Officio Auditor of Emery County, aforesaid, in consideration of the premises, and pursuant to the provisions of Title 80, Chapter 10, Section 66, Revised Statutes of Utah, 1933, hereby conveys to Emery County, the said party of the second part, all that certain piece or parcel of land situated in Emery County, State of Utah, and described as follows, to-wit:

SW¼ NE¼; SE¼ NW¼; SE¼ of Sec 16 Twp 18 South Range 8 East of S.L.M. Containing 240 acres.

WITNESS my hand and seal as County Clerk and ex-Officio Auditor of said Emery County, personally appeared before me as above written. Signed, sealed and delivered in the presence of

Carlos G. Larsen

Hector L. Peterson
County Clerk and ex-Officio Auditor of Emery County.

CORPORATE Seal Co. Clerk

STATE OF UTAH, } ss.
County of Emery. }

On the First day of April, 19 37, personally appeared before me as County Recorder of Emery County, State of Utah Hector L. Peterson the County Clerk and ex-Officio Auditor of Emery County, State of Utah, the signer of the foregoing instrument, who duly acknowledged to me that he, as such County Clerk and ex-Officio Auditor of Emery County, aforesaid, executed the same.

CORPORATE Seal Co. Recorder

Zenda Davis
County Recorder of Emery County, Utah.

Recorded at request of Hector L. Peterson this 7th day of June, 19 37

Aud. Tax Deed Book 4-S Page 107

Zenda Davis
Recorder of Emery County, Utah.

At 2:25 P. M.

When Recorded Return to:

EMERY COUNTY CLERK
P.O. Box 907
Castle Dale, Utah 84513

WARRANTY DEED

KIRK JOHANSEN and JULIE JOHANSEN, husband and wife, Grantors, of Castle Dale, Emery County, Utah, hereby CONVEYS and WARRANTS to EMERY COUNTY, a body corporate and politic of the State of Utah, Grantee for good and valuable consideration, receipt of which is hereby acknowledged, the following described tract of land in Emery County, State of Utah, to-wit:

The West 1/2 of the West 1/2 of the Northeast Quarter of the Northeast Quarter of Section 16, Township 18 South, Range 8 East, SLB&M. Containing 10.0 acres more or less.

WITNESS, the hands of said Grantors this 22 day of June, 1987.

Kirk Johansen
KIRK JOHANSEN

Julie Johansen
JULIE JOHANSEN

STATE OF UTAH)
ss.
County of Emery)

On the 22nd day of June, 1987, personally appeared before me the signers of the above instrument, who duly acknowledged to me that they executed the same.

Julie D. Wilcox
Notary Public

My Commission Expires:

4-29-91

Residing at Wilcox, Utah

SEP 01 1994

STATE OF UTAH)
)ss
COUNTY OF EMERY)

I, *Ina Lee J. Magnuson*, County Recorder In and For Emery County, State of Utah, hereby certify that the foregoing is a full, true, and correct copy of the original *Patent*.
Recorded in Book *107*, Page *57-58*,
Filing No. *283787*, now on file and record at my office in Emery County, this *24th* day of *March*. A.D., 19*80*.

Ina Lee J. Magnuson
County Recorder

ITEM B

APPENDIX C

EMERY COUNTY LANDFILL
INSPECTION FORM

Performed by: _____ Date: _____

		Overall Condition	
		Satisfactory	**Needs Work ***
I.	**Structures and Roads**		
1.	Buildings	_____	_____
2.	Fences	_____	_____
3.	Gates	_____	_____
4.	Roads	_____	_____

*Specify recommended repairs and/or list actions taken:

_____

_____

_____

II.	**Operations**		
1.	Litter and Weed Control	_____	_____
2.	Excavations	_____	_____
3.	Daily Cover	_____	_____
4.	Intermediate Cover	_____	_____
5.	Final Cover	_____	_____
6.	Segregated Waste Piles		
a.	Scrap Metal	_____	_____
b.	Appliances	_____	_____
c.	Dead Animal Pit	_____	_____
d.	Yard Waste	_____	_____
e.	Construction Debris	_____	_____
f.	Waste Oil/Anti-Freeze Tanks	_____	_____
g.	Used Battery Skid	_____	_____
h.	Recyclables/Reuse Storage Area	_____	_____

*Specify recommended repairs and/or list actions taken:

_____

_____

_____

Routine Waste Inspection Form

Date: _____ Time: _____

Truck Type: _____

Hauler: _____ License/Truck #: _____

Source of Material: _____

Other Information: _____

WEATHER: GOOD__ FAIR__ POOR__ WET__ DRY__ WINDY__

Waste Composition

Composition	Percent by Volume (estimated)
Food Wastes	
Paper/Cardboard	
Plastics	
Textiles/Rubber/Leather	
Dirt/Ashes/Brick	
Vegetative Wastes	
Wood	
Glass	
Metals	
Household Hazardous Waste	
Tires	
Drywall	
Other Hazardous Wastes	

Comments:

Inspector Signature: _____

Date: _____

Approval: _____ Date: _____

OFFICE USE ONLY:
TOTAL TONNAGE _____
APPR. _____

TIRES _____TONS

RECYCLABLES _____TONS

EMERY COUNTY
LANDFILL
RECYCLABLES HAULED OUT

CONTRACTORS _____

OTHERS _____

VEHICLE TOTAL _____

DATE	TIME	LICENSE #	ESTIMATE WEIGHT	HAULING CONTRACTOR	LOAD DESCRIPTION	I.D.

Utah Department of Environmental Quality
Division of Solid and Hazardous Waste
1-800-458-0145

NAME OF BUSINESS _____

DATE _____

UTAH DIYer USED OIL LOG

Acceptable Oil

Motor Oil
Hydraulic Oils
Transmission Fluids

Unacceptable Materials

Solvents
Paint & Varnishes
Household Chemicals
Anti-Freeze
Paint & Lacquer Thinners
Insecticides
Gasoline
Any combination/mix of unacceptable materials with acceptable oil

By signing this log, I certify that the materials submitted consist entirely of "Acceptable Oil" which was removed from a motor vehicle without charge.

	Name	Address	Date	Volume
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

Distribution: White - State / Canary - Collection Center

LANDFILL TRAINING AGENDA

DATE: _____

SUBJECT: _____

SPECIAL SPEAKER: _____

GENERAL TOPICS DISCUSSED:

1. _____
2. _____
3. _____
4. _____
5. _____

THOSE IN ATTENDANCE:

FREON EXTRACTION

MONTH ______________________ **YEAR** _________

DATE	FREON TYPE	MAKE	SERIAL #	OUNCES EXTRACTED	ID

OFFICE USE ONLY
TOTAL TONNAGE _____
APPR. _____

CITY SANIT. _____TONS

M & P SANIT. _____TONS

EMERY COUNTY LANDFILL
WASTE DISPOSAL LOG

CLEAN GREEN _____
OFF SITE

DATE: _____

WEATHER: GOOD__ FAIR__ POOR__

WET__ DRY__ WINDY__

VEHICLES _____

SANITATIONS _____

VEHICLE TOTAL _____

	MAKE	LICENSE #	TIME	GROSS	TARE	NET	CLEAN GREEN	LOAD DESCRIPTION	I.D
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									

MAKE	LICENSE #	TIME	GROSS	TARE	NET	CLEAN GREEN	LOAD DESCRIPTION	I.D

Emery County Municipal Landfill

HOT LOAD

Weather Conditions: _____

Date of Incident: _____ Time of Incident: _____ am/pm

Name of Carrier bringing in Hot Load: _____

Name of Driver: _____ Drivers License #: _____

Vehicle License #: _____ Vehicle Make or ID #: _____

1. Did driver advise employee that he had a hot load? Yes _____ No _____
   Explain: _____

   A. What instructions were given to the driver? _____

   B. Where was the Hot Load deposited for observation? _____

   C. Were Hot Load procedures followed? Yes _____ No _____ If no explain

   D. Did screener communicate Hot Load information to the operator? Yes _____
   No _____ If no explain _____

   E. Did operator follow Hot Load to site? Yes _____ No _____ If no explain

2. Was the Landfill Supervisor called: Yes _____ No _____ If no explain _____

3. Was the Fire Department called to respond? Yes _____ No _____ If no explain

   A. Name of responding Fire Department(s): _____

   B. Number and type of fire units responding: _____

   C. Method used by firefighters: Water _____ Other _____
   If other explain _____

   D. Name of Fire Crew Chief(s) at scene: _____

4. Was the Sheriff's Office called? Yes _____ No _____ If no explain _____

5. Were Landfill operational procedures followed? Yes _____ No _____ If no explain _____

6. Describe incident in detail: _____

7. Was this an avoidable incident? Yes _____ No _____ If yes explain _____

A. How could this incident have been avoided? _____

8. Was there property damage? Yes _____ No _____ If yes explain _____

9. Was damaged property insured: Yes _____ No _____

A. Insurance Company or Agency Name and Policy #: _____

10. Employee comments regarding incident/accident: _____

Operator's Signature _____

Screener's Signature: _____

Supervisor's Signature: _____

Date: _____

EMERY COUNTY LANDFILL
QUARTERLY METHANE MONITORING REPORT

Name:_____ Date:_____

Was the methometer calibrated before use? Yes / No

LOCATION	READING	UNITS
Inside Operator's Shack (max 25% of LEL)		
Shop (max 25% of LEL)		
Front Gate (max 100% of LEL)		
NW Corner of Fence (max 100% of LEL)		
NE Corner of Fence (max 100% of LEL)		
SE Corner of Fence (max 100% of LEL)		
SW Corner of Fence (max 100% of LEL)		

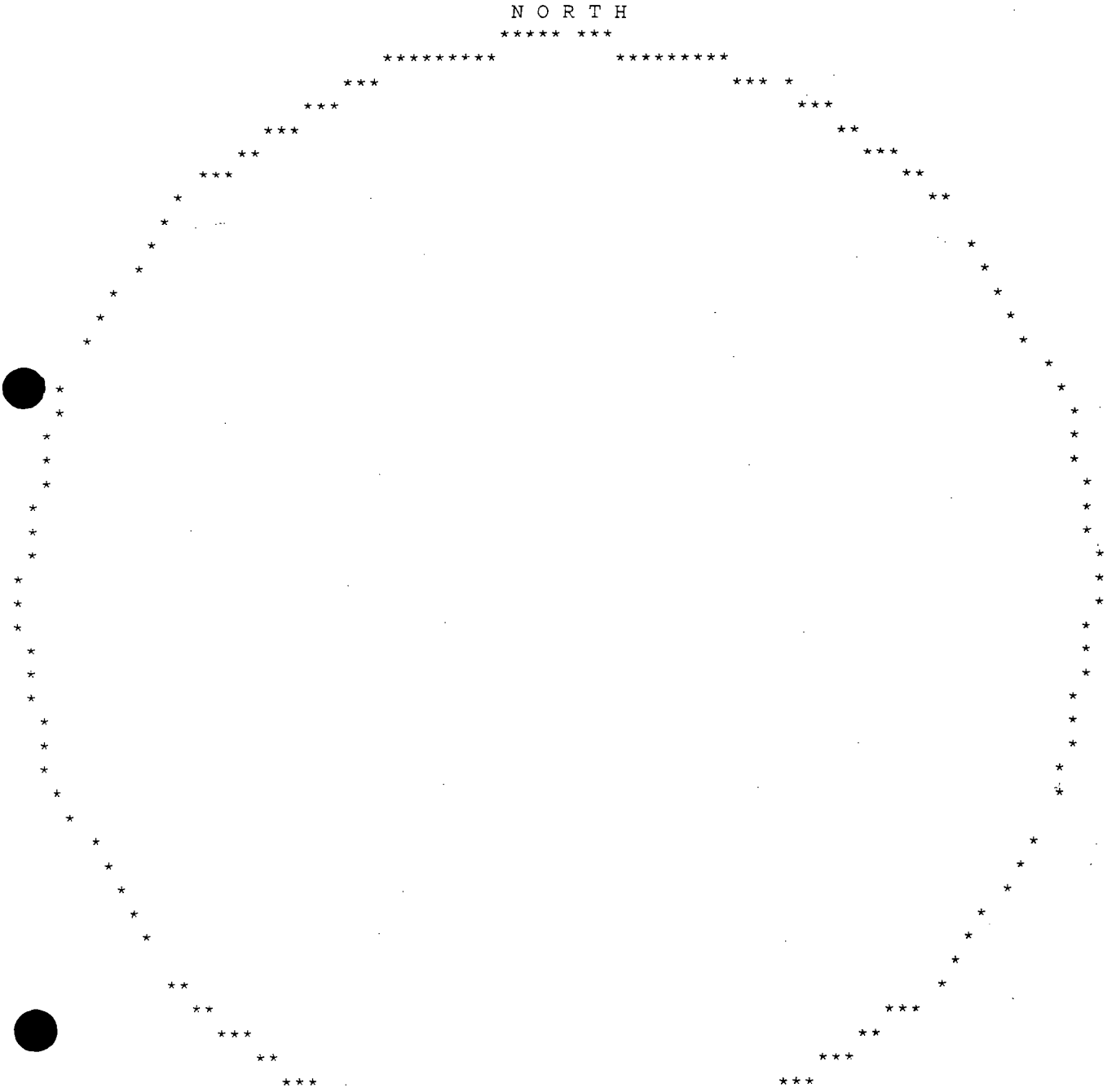
Comments/Observations/Actions Taken:_____

APPENDIX D

UTAH DIVISION OF WATER RIGHTS
WATER RIGHT POINT OF DIVERSION PLOT CREATED TUE, FEB 4, 2003,
PLOT SHOWS LOCATION OF 0 POINTS OF DIVERSION

PLOT OF AN AREA WITH A RADIUS OF 2800 FEET FROM A POI
S 1050 FEET, E 2100 FEET OF THE NW CORNER,
SECTION 16 TOWNSHIP 18S RANGE 8E SL BASE AND MERIDI

PLOT SCALE IS APPROXIMATELY 1 INCH = 1000 FEET

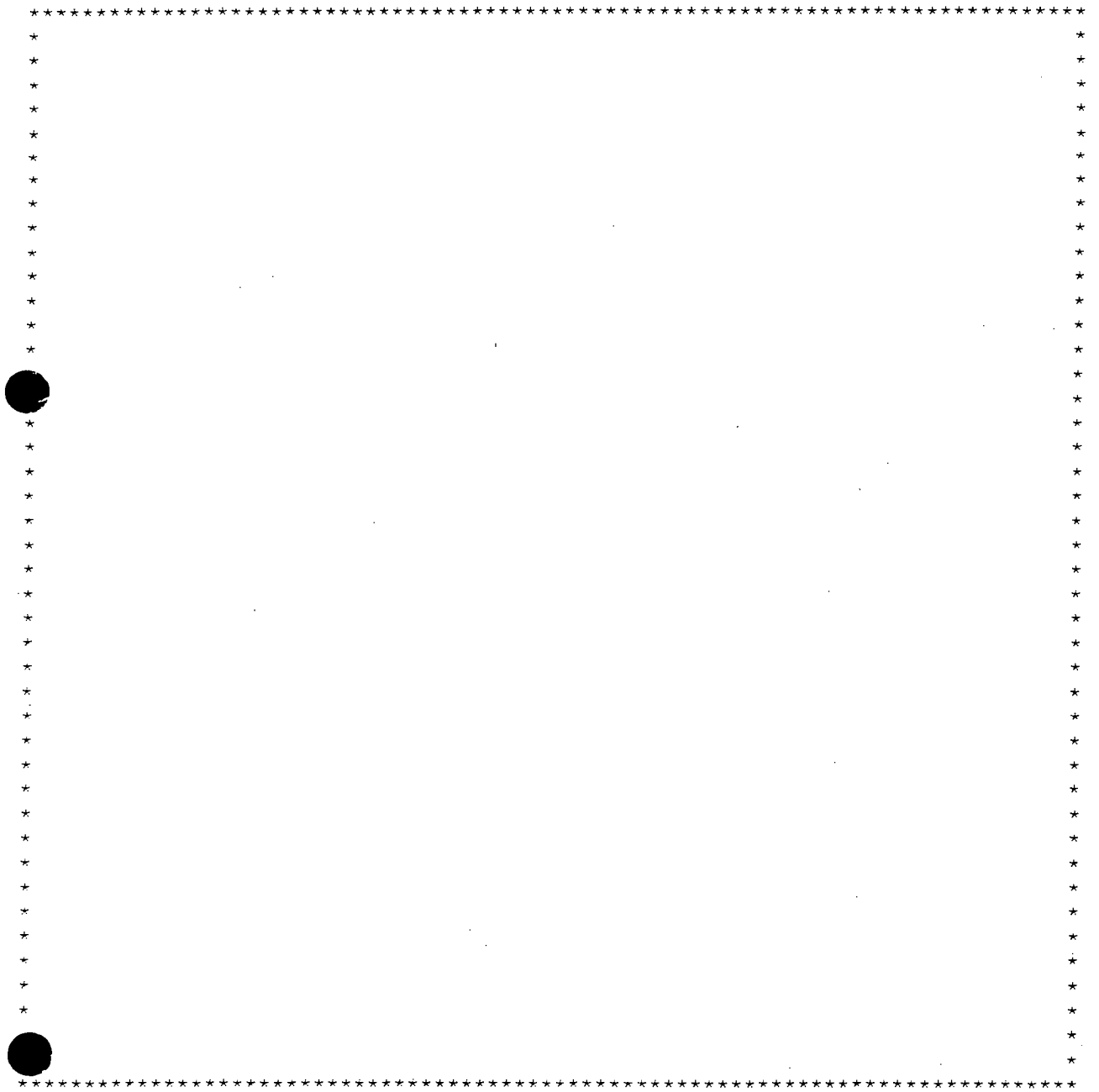


UTAH DIVISION OF WATER RIGHTS
WATER RIGHT POINT OF DIVERSION PLOT CREATED TUE, FEB 4, 2003,
PLOT SHOWS LOCATION OF 0 POINTS OF DIVERSION

PLOT OF ALL QUARTER(S) IN SECTION 16 TOWNSHIP 18S RANGE 11E SL

PLOT SCALE IS APPROXIMATELY 1 INCH = 1000 FEET

N O R T H



APPENDIX E

TAHOMA COMPANIES, INCORPORATED ♦ WDBE
444 South Main Street, Suite C-7
Cedar City, Utah 84720
(801) 865-0131 ☎ fax 865-0161

FILE COPY

July 13, 1995

Jeff Emmons, Environmental Scientist
Division of Solid and Hazardous Waste
Utah Department of Environmental Quality
P.O. Box 144880
Salt Lake City, UT 84114-4880

SUBJECT: **EMERY COUNTY CLASS I LANDFILL REQUEST FOR EXEMPTIONS**

Dear Jeff:

Here's the document we've been discussing for the past months. It contains specific technological support for our request on behalf of Emery County to waive the liner construction, leachate control designs, and ground water monitoring requirements under Utah's Administrative Rules.

Our permit application does not include liner and leachate control designs or provisions for ground water monitoring, so very little would have to be rewritten if this exemption is approved.

We will have some changes to the general layout and operation of the landfill which will be incorporated into the application, but those changes are relatively minor and greatly enhance the Landfill as a public utility.

Gary and I would like to meet with you as soon as a decision is made on the exemption to facilitate final submission of the permit application. Unless you plan a trip to southern Utah in the next few weeks, that meeting should probably take place in Salt Lake City. Please get back with Gary or me to set the appointment.

Sincerely,

Connie Lynne Player
President

Enclosure: Request for Exemption from Liner, Leachate Control, and Ground Water Monitoring dated July 13, 1995

CC: Bevan Wilson, Emery County Commissioner
Rex Funk, Emery County Road Department Superintendent

FILE: K:\CLIENTS\93683-3\CORRES\JE-EXIMP.LTR

EMERY COUNTY LANDFILL

REQUEST FOR EXEMPTION FROM LINER, LEACHATE CONTROL, AND GROUND WATER MONITORING

Prepared for Emery County Commission

for the use of

Dennis R. Downs, Director
Division of Solid and Hazardous Waste
Utah Department of Environmental Quality
Post Office Box 144880
Salt Lake City, Utah 84114-4880

Dated

July 13, 1995

Prepared by

TAHOMA COMPANIES, INCORPORATED ♦ WDBE
444 South Main Street, Suite C-7
Cedar City, Utah 84720
(801) 865-0131 (fax) 865-0161
FILE: SHARE\CLIENTS\REPORTS\WAIVER.RPT

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APPENDICES

INTRODUCTION

The Emery County Landfill (ECL) is an operating Class I landfill near Castle Dale, Emery County, Utah. It was constructed in 1983 in the NE 1/4 of section 16, T. 18 S., R. 8 E., Salt Lake Baseline and Meridian. The ECL originally operated under older regulations but has now been upgraded in order to meet the Utah Solid Waste Permitting and Management Rules (UAR R513-301-2). Tahoma Companies, Incorporated of Cedar City, Utah, has been retained by Emery County to design future landfill units and to prepare the permit application and other documents needed for compliance under the current regulations.

Tahoma has concluded that the site is adequate for operation of the ECL without installation of a landfill liner system, leachate control or ground water monitoring. This Request for Exemption contains the technical justification for operation of the ECL without those systems.

LEGAL BASIS FOR GRANTING AN EXEMPTION

LANDFILL LINER

The basis for obtaining an exemption from the requirement for construction of a landfill liner is described in Subsection R315-303-4(3)(c)(i) of the UAR. It states:

> The owner or operator may use, as approved by the Executive Secretary, alternative design, operating practices, and location characteristics which will minimize the migration of solid waste constituents or leachate into the ground or surface water which are at least as effective as the liners of Subsections R315-303-4(3)(a) or (b).

The regulation further states in Subsection R315-303-4(3)(c)(ii) that:

> The owner or operator must demonstrate the standard of Subsection R315-303-3(1) can be met. The demonstration must be approved by the Executive Secretary, and must be based upon:
>
> A) the hydrogeologic characteristics of the facility and the surrounding land;

B) the climatic factors of the area;

C) the volume and physical and chemical characteristics of the leachate; and

D) predictions of contaminate fate and transport in the subsurface that maximize contaminant migration and consider impacts on human health and the environment;

LEACHATE COLLECTION SYSTEM

Subsection R315-303-4(2) states that a leachate collection system is required only for "a landfill required to install liners." The ECL will not construct a leachate collection system if a landfill liner is not required.

GROUND WATER MONITORING

The basis for obtaining a waiver from ground water monitoring is found in UAR Section R315-308. The rule states that the requirements "may be suspended by the Executive Secretary if the owner or operator of a solid waste disposal facility can demonstrate that there is no potential for migration of hazardous constituents from the facility to the ground water during the active life of the facility and the post-closure care period."

The demonstration must be based on measurements collected at specific field sites, including sampling and analysis of physical, chemical and biological processes affecting the fate and transportation of contaminants. Predictions of the fate and transportation of contaminants should be based on the maximum possible distance of the migration of contaminants and a consideration of the impacts on public health and safety and the environment.

SCOPE OF WORK

This report presents technical data and interpretations of the data that demonstrate that little or no leachate will be generated by the ECL. The report also shows that any leachate generated will not adversely impact ground water, human health or the environment.

The most important factors governing leachate generation and migration at the Emery County Landfill are:

1) Climate;
2) Initial moisture content of the waste and soils at the site;
3) Local and regional geological setting of the site; and
4) Surface and ground water hydrology at the site.

Initial studies for the landfill permit application included literature reviews of published information about (1) the climate at Castle Dale and other communities with analogous climates, (2) regional and site-specific geology of Emery County, and (3) surface and ground water hydrology of the Emery County Landfill. Initial studies were followed by the construction of several test pits and one test boring to obtain subsurface information from the site.

The potential for leachate generation was studied by modeling with the Help3 computer program, version 3.04 (March 13, 1995). This program was written by the U.S. Army Corps of Engineers for the U.S. Environmental Protection Agency specifically for the evaluation of landfills and leachate generation.

CLIMATE

The climate at Castle Dale is semiarid. Average annual precipitation is 7.52 inches (Ashcroft, et. al., 1992). Most of the precipitation occurs from July through October as thunder storms. Normal mean temperatures range from 21.7 degrees Fahrenheit in January to 71.7 degrees Fahrenheit in July. The maximum recorded temperature is 103 degrees F., while the record minimum temperature reported is 35 degrees F. below zero. Evapotranspiration averages 48.07 inches per year.

Pan evaporation from open bodies of fresh water has not been measured at Castle Dale. An approximation of pan evaporation for Castle Dale can be made by comparing evapotranspiration values with pan evaporation values. Pan evaporation averaged about 30 percent greater than evapotranspiration at six Utah desert climate stations (Moab, Arches National Park, Green River Aviation, Milford, St. George and Hite). If the relationship is correct for Castle Dale, then pan evaporation at Castle Dale would be about 62.5 inches per year.

Default records for temperature and precipitation were not provided for Castle Dale, Utah in the Help3 computer program. Therefore, temperature and precipitation from several

communities with climates similar to Castle Dale that were provided were used to approximate Castle Dale's climate. The two most similar climates are found in Grand Junction, Colorado and Milford, Utah. Grand Junction has virtually the same precipitation, but averages about 5 degrees Fahrenheit warmer every month. Milford's temperatures are very similar to those reported for Castle Dale, although average rainfall is about 25 percent greater.

The best "fit" to Castle Dale climate information was determined to be a combination of rainfall records from Grand Junction, Colorado, with temperature and solar radiation records from Milford, Utah. Climatological data for Castle Dale and Milford have been provided as Appendix A.

INITIAL MOISTURE CONTENT OF WASTE AND SOILS

This discussion of initial moisture content in layers of a proposed landfill unit is presented in sequence from the top down. The uppermost materials are 6 (six) inches of silty sands with a moisture content of about 15 percent to be used for revegetation of the closed landfill unit. The next layer is 18 (eighteen) inches of compacted clay with initial moisture content of about 25 percent. The next units modeled consist of alternating 36 (thirty six) inch layers of compacted municipal waste with initial moisture contents ranging from 15 to 20 percent, and six (inch) layers of silty sand used for daily cover soils. Initial moisture content for the daily cover sands was 10 percent.

Basis for Initial Moisture Content Assumptions

Few observations are available about the initial moisture content of municipal waste in Utah. Vector Engineering (1991) conducted a waste sort at the Winnemucca, Nevada, landfill. Vector concluded that the initial moisture content for waste at Winnemucca was 13.64 percent, or .1364 volume per volume.

A relatively high proportion of Winnemucca waste consists of food wastes from casinos, restaurants and hotels. Food waste is one of the major contributors of moisture (Tchobanaglous, 1977). The Emery County waste stream has a lower food waste content because there are very few restaurants and no known casinos in the county. However, in order to present conservative results, relatively high initial moisture values (17.5 percent through 22.50 percent) for Emery County wastes were used in computer simulations of leachate generation.

Daily cover soils at the ECL are prepared by crushing soft sandstone cobbles and boulders found in the pediment gravel that mantles the landfill site. The resulting gravelly silty sands are virtually dry. They have been assigned an initial moisture content of 10 percent for use in the Help3 computer model.

Fractured shales of the Blue Gate member of the Mancos Shale formation directly underlie the proposed landfill unit. The shales have about 0.041 percent fracture porosity. The open fractures have been assigned an initial moisture content of 0.035 percent (based on known moisture contents of similar soils) for use in the computer model.

GEOLOGICAL SETTING

The Emery County Landfill is underlain by approximately 3,000 feet of Mancos Shale Cretaceous bedrock covered with a thin (less than 25 feet) veneer of pediment gravel. The only bedrock unit exposed at the landfill is the Blue Gate Member of the Mancos Shale (Ellis and Frank, 1981). A portion of their map is included in Appendix B as Figure A.

Areal Distribution of the Mancos Shale near the Emery County Landfill

Middle and upper Cretaceous rocks are widespread throughout much of central and eastern Utah. The largest region of relatively level land in the area is underlain by Mancos Shale. The Mancos Shale lowlands form a broad border on the west, north and northeast sides of the San Rafael Swell and then swing eastward parallel with the Book Cliffs into western Colorado. Most of the agricultural settlements of Emery, Carbon and Grand Counties are located in the Mancos Shale Lowlands.

The Emery County Landfill (ECL) is located on the western edge of the Castle Valley portion of the Mancos Shale Lowlands. The rocks are gently folded and dip variably to the northeast, north and northwest at about six degrees or less. The thick shales continue to the west but disappear into the subsurface under younger Cretaceous sandstones that form cliffs along the eastern boundary of the Wasatch Mountains.

A published geologic map and cross section (Witkind, 1988) show that the Blue Gate Member of the Mancos Shale extends eastward across Castle Valley towards its outcrop edge approximately five miles east of Castle Dale. The Mancos Shale has been eroded away east of Castle Valley but is visible again to the north and east on the flanks of the San Rafael Swell. Part of Witkind's cross section is included with Appendix B as Figure B.

The Blue Gate Member, of middle to upper Cretaceous age, consists of about 1600 feet of light bluish gray and gray shale and shaly siltstone. The shale is thin to medium bedded and contains rare, thin silty sandstone layers. The shale weathers into thin, tabular fragments and forms low, rounded hills.

The lower portion the Emery Sandstone Member of the Mancos Shale is exposed on property owned by Emery County, about 1,000 feet west of the landfill. This unit consists of about 90 feet of interbedded gray to yellow sandstone, siltstone and silty shale. The rocks occur on slopes uphill from the landfill and do not extend under the ECL.

Porosity and Permeability of Fractured Blue Gate Member Rocks

Surface measurements of fracture spacing in the Blue Gate Member by Tahoma Companies, Incorporated showed that effective porosity in the weathered zone may be as high as four percent. This high value was obtained by artificially fracturing the rocks with a ripper tooth, measuring the joint spacing in the resulting rubble and assuming an average width for open fractures of 0.05 inches (1.27 millimeters, or 1,270 microns).

David T. Snow (1968) compiled information on fracture porosity and permeability in bedrock from more than 5,000 pressurized water-injection measurements at 35 dam sites. His data showed that porosity decreases immediately below the weathered zone to an average of about 0.05 percent near the surface. Measured porosity decreases to 0.005 percent at a depth of 200 feet and to 0.0005 percent at 400 feet below the surface. He also reported that the average size of fracture openings decreases from about 100 microns near the surface to about 50 microns at 200 feet.

Snow concluded that fracture porosity distribution was essentially the same for all competent rock types whose intergranular permeability is very small compared to fracture permeability, including shales and siltstones such as those present in the Blue Gate Member. Decreasing permeability with depth was found to be the result of decreasing fracture openings. Snow's fourth conclusion (pages 89 and 90) best describes fracture porosity to be expected at the Emery County Landfill:

> ...At any site on fractured rock, fracture porosity decreases with depth. Other sites on the same rock type have different trends, but the maximum porosity is about 0.05 percent near the surface, decreasing by an order of magnitude each 200 feet within the depth of usual dam-site explorations. Shattered or weathered rock near the surface *or rocks disturbed by excavation* doubtless exceed these limits. [*Italics added].*

Snow (page 88) stated that highly porous fractured rocks in the weathered zone generally were present to depths of 5 to 10 feet below ground level. Virtually all of the leachate predicted by worst case modeling with HELP3 would be stored in the weathered zone at the top of the Blue Gate Member under the ECL.

Regional Hydrogeology of the Ferron Sandstone Aquifer

The only significant aquifer near the ECL is the Ferron Sandstone Member of the Mancos Shale. The Ferron occurs directly below the Blue Gate Member about 1,600 feet below ground at the ECL.

Permeable sandstones in the Ferron Member contain potable ground water near Emery, Utah, about 25 miles southwest of the ECL. Several analyses of water from townships closer to the landfill all disclosed salinities ranging from 3,800 to 21,000 mg/Liter--unsuitable for human consumption (Lines and Morrissey, 1983).

The closest sample of Ferron ground water tested by Lines and Morrissey was obtained from a well only four miles northwest of the ECL. Water from that location had a total dissolved solids content of 14,541 mg/Liter.

The largest source of recharge to the Ferron Sandstone aquifer is subsurface inflow from the west under the Wasatch Plateau. Subsurface inflow near Emery was estimated by Lines and Morrissey at 2.4 cubic feet per second. Most of this moves laterally through crushed zones in the Joes Valley fault system. Lines and Morrissey also stated that "little" water is recharged to the aquifer by precipitation on the outcrop area.

Data from Lines and Morrissey suggest the following conclusions about water in the Ferron Sandstone aquifer at the Emery County Landfill:

1) Regional subsurface ground water flow in the Ferron Sandstone is from west to east;

2) Water four miles northwest of the ECL has a total dissolved solids content of about 14,000 mg/Liter;

3) Infiltration from the surface to the Ferron Sandstone is negligible;

4) Water quality in the Ferron Sandstone under the ECL is probably comparable to that in a well four miles to the northwest.

Regional Hydrogeology of the Blue Gate Member of the Mancos Shale

Hydrogeology of the Blue Gate Member of the Mancos Shale has not been studied in detail by published authors. The reason for this is that the Blue Gate Member is not considered a good aquifer. An aquifer is defined as: *a permeable geologic unit that can transmit and store significant quantities of water* (Maidment, 1992). The Blue Gate is permeable where fractured, but neither transmits nor stores significant quantities of ground water. Lines and Morrissey reported five analyses of water from the Blue Gate Member in Emery County. Only two of their analyses are from localities within 10 miles of the ECL:

> Water from an exploratory boring 10 miles northeast of the ECL was analyzed by Chemical and Geological Laboratories in 1954. Water from 120 to 200 feet below ground contained 22,600 mg/Liter total dissolved solids. This water was sampled from an elevation of about 6,000 feet.
>
> Water has also been analyzed from a spring in the Mancos Shale about five miles southeast of the ECL. Water from the spring contained 5,080 mg/Liter total dissolved solids. The spring was sampled in May of 1978. Seasonal variations in flow and salinity from analogous springs suggest that the total dissolved solids could be much higher in the summer months. This water is produced from a small perched aquifer on Oil Well Dome at an elevation of about 5,700 feet.

On Friday, February 17, 1995, Tahoma's geologist, Gary F. Player, visited the spring referenced by Lines and Morrissey and made the following observations:

1) The spring does <u>not</u> issue from the Blue Gate Member of the Mancos Shale. The Blue Gate Member is that portion of the Mancos Shale <u>above</u> the Ferron Sandstone.

2) Water from rain and snow-melt that accumulates on Oil Well Dome percolates downward through Ferron Sandstone outcrops to the top of the Lower Member of the Mancos Shale. Water moves laterally on and above the contact between the Ferron Sandstone and underlying low permeability shales. Water then surfaces in springs in a gully along the northwest side of Oil Well Dome.

3) The Ferron Sandstone aquifer that transmits water to the spring is restricted to that portion of Oil Well Dome above 5,700 feet.

4) The Ferron Sandstone aquifer at Oil Well Dome is not connected to the rocks that underlie the Emery County Landfill. Sandstone beds have been eroded away west of the dome and are not continuous to the west.

5) Water issuing from the spring is captured in Dutchman's Wash, a tributary of Cottonwood Creek that flows eastward, ultimately, to the San Rafael River.

Waters from the other three, more distant, Blue Gate sample locations ranged from 4,040 to 19,400 mg/Liter total dissolved solids.

Site Specific Hydrogeology of the Blue Gate Member of the Mancos Shale

Hydrogeology of the Blue Gate Member of the Mancos Shale at the ECL has been investigated with a test boring, ECL #1. The test boring was drilled upgradient from the active landfill at a point 50 feet west from the fence along the western boundary of the landfill.

ECL #1 was drilled to a depth of 440 feet below ground level (BGL). Cobbles and boulders of the Pediment Gravel were encountered from the surface to 19 feet BGL. Materials in the remainder of the boring consisted of dark gray to black mudstone shale mixed with blue-gray siltstone. The hole was drilled with compressed air so that any ground water would be readily observable.

A few drops of vadose zone water were encountered in drill cuttings at about 140 feet BGL. A small amount of this water (less than 10 gallons) accumulated in the boring over night after the hole had been advanced to 180 feet on May 30, 1995. This water was blown out of the hole with compressed air when drilling resumed on May 31, 1995. The hole then remained dry until the drill reached a depth of 372 feet BGL. A small quantity of water in fine grained sandstone was encountered at that depth. Just enough water was present to mix with the cuttings and form a thick mud that could not be lifted to the surface by compressed air.

The driller then switched over from air circulation to fresh water and drilled ahead to 440 feet BGL, the total depth of the test boring. The driller then switched back to circulating with air and was able to blow the hole clean of mud and some ground water. The hole was allowed to sit for one hour and forty five minutes, after which about 5 gallons of Blue Gate Member ground water were air-lifted to the surface and sampled for analysis.

Water from ECL #1 was analyzed by the Southern Utah University Water Laboratory. Total dissolved solids (TDS) was 38,400 mg/Liter. This TDS value may be somewhat lower than the actual ground water concentration, as dilution by fresher drilling water probably occurred. The laboratory value can be considered the minimum back ground TDS concentration of naturally occurring ground water upgradient from the landfill. The complete laboratory analysis of this sample is included as Appendix C.

SUMMARY OF HYDROGEOLOGICAL CONDITIONS

The results of the literature search and site specific field investigations have been incorporated in the following conclusions about the ECL:

1) Rocks beneath the landfill consist of a thin (less than 25 feet) veneer of pebbles, cobbles and boulders overlying about 1,600 feet of siltstone and mudstone shale of the Blue Gate Member of the Mancos Shale formation.

2) An unconfined water-bearing zone exists in the Blue Gate Member at about 370 feet BGL. Small quantities of vadose water were encountered at about 140 feet BGL, but the rocks were dry from 140 to 372 feet BGL in test boring ECL #1.

3) Ground water sampled from the Blue Gate Member upgradient from the ECL is high in dissolved solids, with TDS equal to at least 38,400 mg/Liter.

4) A field measurement of permeability in weathered siltstones at the top of the fractured Blue Gate Member disclosed a permeability of 1×10^{-3} cm/second.

5) Blue Gate Member rocks contain about 4.1 percent fracture porosity in the weathered zone from about 5 (five) to 10 (ten) feet below the top of the shale.

6) Over 5,000 studies of similar rocks show that the fracture porosity of the Blue Gate Member will decrease to 0.005 percent at 200 feet below ground level and 0.0005 percent at 400 feet below ground level.

LANDFILL DESIGN AND OPERATION

Important elements of the landfill design and operation will minimize leachate generation and subsequent migration. Design elements include proposed landfill unit geometry, run-on and run-off control, waste screening, waste placement, daily cover and final closure cover. The design and operational elements summarized below are discussed in the application for a permit to operate the ECL previously submitted to the Utah Division of Solid and Hazardous Waste.

NEW LANDFILL UNIT

Proposed new landfill units at the Emery County Landfill will be constructed by excavating through surface pediment gravel to the underlying Mancos Shale. Average thickness of the surface gravel, as determined from backhoe-excavated test pits, is less than 25 feet.

The excavated gravel will be crushed and stockpiled. Fine materials unsuitable for use as road fill by Emery County Road Department will be retained at the landfill for use as daily cover.

Each landfill unit will be excavated as a rectangular pit with a floor depth of about 30 feet BGL. All pit walls will be laid back at slopes of one (horizontal distance) to one (vertical distance).

SURFACE WATER CONTROLS

Run-On Control

The proposed design locations for two new landfill units at the Emery County Landfill are in the extreme northeast corner of the landfill property. The landfill units will be placed in a 10 acre parcel described as follows:

> West 1/2 of the West 1/2 of the Northeast quarter of the Northeast quarter of Section 16, Township 18 South, Range 8 East.

Potential run-on from areas north and west of the existing fenced landfill is deflected by topography into a deeply incised (approximately 15 feet deep) northwest- to southeast-trending channel that runs parallel to the landfill fence, approximately 500 feet southwest of the fence line.

Flooding potential for the existing landfill is low. However, Tahoma has recommended that a ditch be constructed along the entire northern perimeter of the fenced landfill area. This ditch would deflect all potential run-on from the north of the facility into natural drainages east of the Emery County Landfill.

Two existing drainages in the westernmost portion of the landfill capture any sheetflow entering the landfill from the west. Water from these existing drainages is carried out of the landfill under the landfill access road in a 36-inch diameter corrugated metal pipe culvert.

Run-Off Control

Proposed new landfill units for the Emery County Landfill will be excavated 30 feet BGL. As long as run-on is minimized, run-off control is not necessary. Water could run-off from the active pits only if an unanticipated record storm dropped sufficient rainfall directly into a landfill unit to saturate the compacted waste and cover material and then fill the remaining unused space.

LIQUID WASTE

Keeping prohibited wastes, including liquid wastes, out of the landfill is of primary concern for the safe operation of the landfill. The landfill operators are required to receive periodic training using materials developed by SWANA.

A detailed description of the waste screening program can be found in the *Emery County Landfill Operator's Manual*, including definitions of hazardous wastes and how to identify them.

All loads will be visually inspected as they enter the landfill. Random inspections of incoming loads will be conducted according to the schedule determined by the Landfill Supervisor. SWANA recommends that one load per week be considered the minimum effort required.

DAILY AND FINAL COVER

Solid waste accepted at the landfill is spread in thin layers and compacted. The materials are allowed to dry out at the landfill face before daily cover is applied. Daily cover consists of a minimum of six inches of dry mineral soils. Daily application of cover materials reduces the area of waste directly exposed to precipitation and minimizes infiltration. Compacted daily cover also retains moisture from precipitation near the surface within the zone of evaporation.

Final cover will be applied at the end of the active life of each landfill unit. The final cover will be graded to enhance run-off and minimize infiltration into the closed landfill. Careful maintenance of the closed landfill will limit the volume of water available for leachate generation and migration.

The cover will consist of at least 18 inches of mineral soils with a permeability less than or equal to 1×10^{-5} cm/second. The 18 inches of low permeability mineral soils will be covered with an additional 6 inches of soils capable of supporting native vegetation in order to minimize erosion. The final cover is described in detail in the Closure Plan submitted with the landfill permit application.

SUMMARY OF LANDFILL DESIGN AND OPERATIONAL FEATURES TO MINIMIZE LEACHATE GENERATION AND INFILTRATION

The design and operation of the landfill as discussed above will protect the waters of the State from degradation and protect public health and the environment. The following conclusions are pertinent:

1) Each planned landfill unit has a small surface area (less than 5 acres) to minimize direct precipitation.

2) Compacted waste will be allowed to dry before being covered each day with at least six inches of mineral soils.

3) Daily cover will minimize infiltration from precipitation.

4) Each landfill unit will receive final cover as soon as it is filled.

5) Final cover will be graded, vegetated and maintained to minimize infiltration from direct precipitation.

6) Liquid wastes will be excluded from the landfill.

7) Appropriately sized dikes and/or ditches will exclude surface water run-on from entering the active landfill unit(s).

COMPUTER MODELING OF LEACHATE GENERATION AND INFILTRATION (HELP3)

An estimate of leachate to be generated at the ECL is necessary in order to evaluate the need for landfill liners, leachate controls, and ground water monitoring. The total volume of leachate can be compared to effective porosity and permeability of the underlying Blue Gate Member of the Mancos Shale in order to estimate vertical migration of leachate from the landfill.

The Hydrologic Evaluation of Landfill Performance (HELP) model was developed to help evaluate the hydrologic performance of proposed landfill designs. The model accepts weather, soil and design data and uses solution techniques that account for the effects of surface storage, snowmelt, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, subsurface drainage, unsaturated vertical drainage, and leakage through soils. Various combinations of layers and materials may be modeled. Results are expressed as monthly, annual, and long-term average water budgets.

DESIGN OF LANDFILL MODEL

The landfill model is described in the first seven pages of each Help3 output report (see Appendix D). This summary discussion of the layers includes information on initial moisture content for each layer.

Initial moisture content in layers of a proposed landfill unit is presented in sequence from the top down. The uppermost materials are six inches of silty sands with a moisture content of about 15 percent to be used for revegetation of the closed landfill unit. The next layer is 18 inches of compacted clay with initial moisture content of about 25 percent. The next units modeled consist of alternating 36 inch layers of compacted municipal waste with initial moisture contents ranging from 17.5 to 22.5 percent, and six inch layers of silty sand used for daily cover soils. Initial moisture content for the daily cover sands was 10 percent. The lowermost layer (layer 19) is a 10 foot thick (120 inch) zone of weathered and fractured Blue Gate Member shale with an initial moisture content of 3.5 percent.

LEACHATE GENERATION

None of the Help3 model runs showed leachate percolation through layer 19, the lowermost layer of the Emery County Landfill model.

For Help3 Run 16, an initial moisture content of 22.5 percent was assigned to the compacted municipal waste. The maximum amount of water stored in layer 19 at the end of the five year simulation was 4.278 inches. That is sufficient to raise the moisture content in layer 19 from the initial moisture content of 3.5 percent water to 3.56 percent water.

The following table summarizes the results of the three most representative Help3 computer model "runs:"

HELP3: SUMMARY DATA

HELP3 RUN NUMBER	INITIAL MOISTURE IN WASTE (%)	AVERAGE PRECIPITATION (INCHES)	LEAKAGE THROUGH LAYER 19 (INCHES)	FINAL WATER STORAGE IN LAYER 19 (IN.)
14	17.5	7.24	0.00000	4.2498
15	20.0	7.24	0.00000	4.2583
16	22.5	7.24	0.00000	4.2780

PROBABLE CHEMICAL COMPOSITION OF LEACHATE

No leachate has ever been observed at the Emery County Landfill. Therefore, no chemical analyses of leachate have been obtained. Analyses of typical leachate from municipal solid waste landfills in humid portions of the United States have been summarized by the Solid Waste Association of North America (SWANA). The following table lists expected constituents and concentrations for leachate generated from municipal solid waste landfills:

TYPICAL LEACHATE CHARACTERISTICS

CONSTITUENT	CONCENTRATION RANGE (mg/Liter)	TYPICAL CONCENTRATION (mg/Liter)
5 day BOD	2,000 - 30,000	10,000
Total Organic Carbon	1,500 - 20,000	6,000
Chemical Oxygen Demand	3,000 - 45,000	18,000
Total Suspended Solids	200 - 1,000	500
Alkalinity as CaCO3	1,000 - 10,000	3,000
pH	5.3 - 8.5	6
Total Hardness as CaCO3	300 - 10,000	3,500
Calcium	200 - 3,000	1,000
Potassium	200 - 2,000	300
Sodium	200 - 2,000	500
Chloride	100 - 3,000	500
Sulfate	100 - 1,500	300
Total Iron	50 - 600	60
Magnesium	50 - 1,500	250

Other leachate constituents may include small concentrations of volatile organic compounds.

SUMMARY AND CONCLUSIONS

Tahoma Companies, Incorporated, consultant to Emery County, recommends that the Emery County Landfill continue to operate without the construction of a landfill liner, monitoring wells or a leachate control system. The design of the landfill, climate at Castle Dale, operating procedures, hydrogeological setting and physical characteristics of waste accepted for disposal combine to minimize potential contaminant migration. Impacts on public health, safety and the environment will be minimal.

Emery County is currently operating the landfill near Castle Dale, Utah. The landfill has been upgraded to conform to the current Utah Solid Waste Permitting and Management Rules. The rules allow waivers of requirements for landfill liners, ground water monitoring and leachate control if the climate, hydrogeology, and predicted volume of leachate generation and migration meet criteria described in the regulations.

The climate at Castle Dale is semi-arid, with average precipitation of about 7.5 inches. Evapotranspiration exceeds precipitation by a factor of more than 6 times, while probable pan evaporation exceeds precipitation by a factor of more than eight. Temperatures are virtually the same as at Milford, Utah, while precipitation is the same as at Grand Junction, Colorado.

Soils and compacted municipal wastes both have very low initial moisture contents in Emery County. The low moisture contents are important factors that reduce the predicted generation of landfill leachate and consequent risks to ground water.

The Emery County Landfill site has a safe natural setting that would protect ground water in the unlikely event of leachate generation. Relatively impermeable shales under the site are more than 3,000 feet thick. Small quantities of ground water are present at about 375 feet below ground, and the water contains 38,400 milligrams per liter of total dissolved solids. Fractures occur near the surface in the shales, but the fractures are greatly reduced below 200 feet and virtually closed by a depth of 400 feet below ground. Surface waters are diverted around the landfill by natural and man-made drainages.

Computer modeling of leachate generation and infiltration has shown that no leachate will migrate out of the landfill into ground water. Enough moisture is added by landfill operations only to raise the moisture content of fractured shale under the landfill from 3.50 percent to 3.56 percent over a postulated five year period of landfill unit operation.

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CASTLE DALE CLIMATOLOGICAL DATA

County: Emery Lat: 39° 12' Long: 111°, 16' Elevation: 5619 feet Period: 1928-1992

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Normal max temp	35.8	42.9	53.2	63.1	73.1	83.9	89.6	86.9	78.8	66.9	50.7	38.5	63.6
Normal min temp	7.6	14.5	23.3	30.4	38.9	46.9	53.8	51.4	42.3	32.0	21.6	11.3	31.2
Normal mena temp	21.7	28.7	38.3	46.8	56.0	65.4	71.7	69.2	60.5	49.5	36.1	24.9	47.4
Record high temp	62	70	81	85	91	100	103	101	95	87	74	64	103
Record low temp	-34	-35	3	12	18	25	35	32	22	3	-7	-28	-35
Normal pcpn	0.56	0.48	0.56	0.50	0.65	0.46	0.83	0.99	0.76	0.74	0.48	0.52	7.52
Record mly pcpn	1.96	1.69	1.93	1.96	2.73	2.01	3.21	3.27	3.68	3.65	2.68	1.74	3.68
Record dly pcpn	0.73	1.10	0.95	0.92	1.07	1.09	1.43	1.35	1.39	1.24	1.49	0.96	1.49
Normal snowfall	6.6	3.8	1.7	0.6	0.0	0.0	0.0	0.0	0.0	0.2	1.3	3.8	18.0
Record mly snow	24.5	19.9	7.0	6.0	4.0	0.0	0.0	0.0	0.0	4.0	12.1	18.4	24.5
Record dly snow	10.5	8.0	7.0	6.0	4.0	0.0	0.0	0.0	0.0	4.0	7.0	9.5	10.5
Evapotranspiration	0.79	1.31	2.69	4.21	6.05	7.58	8.16	7.05	4.94	3.03	1.42	0.84	48.07

*Percentage of period with data: 91% for temperature, 88% for precipitation, 84% for snowfall.

Reference: Ashcroft, G.L., Donald T. Jensen, and Jeffrey L. Brown, 1992, Utah Climate: Utah Climate Center, USU, Logan, Utah

Milford

County: Beaver Latitude: 38°26' Longitude: 113°01' Elevation: 5030 feet Period: 1928-1992*

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Normal max temp	38.5	45.4	53.3	62.5	73.2	86.0	92.4	89.8	79.9	67.1	51.6	40.2	64.9
Normal min temp	12.5	18.5	24.2	30.4	38.1	46.6	55.3	54.1	43.8	32.5	22.9	14.0	32.7
Normal mean temp	25.5	32.0	38.7	46.4	55.6	65.8	73.8	71.9	61.9	49.8	37.3	27.1	48.8
Record high temp	68	75	80	87	96	105	104	103	99	90	82	66	105
Record low temp	-34	-29	-14	9	17	24	30	34	23	-2	-13	-35	-35
Normal pcpn	0.67	0.67	1.04	0.92	0.86	0.49	0.65	0.99	0.84	0.79	0.73	0.72	9.36
Record mly pcpn	1.86	1.67	2.64	2.28	2.26	2.43	2.85	2.52	3.64	3.75	2.21	2.45	3.75
Record dly pcpn	0.87	0.78	1.14	1.00	1.35	1.29	1.51	1.37	1.42	1.47	0.85	0.93	1.51
Normal snowfall	7.4	7.1	10.5	6.5	1.8	0.0	0.0	0.0	0.4	1.6	4.9	7.1	47.3
Record mly snow	29.8	24.5	29.4	24.4	107.2	0.0	0.0	0.0	8.4	17.4	20.1	30.6	107.2
Record dly snow	11.8	11.2	11.6	9.6	101.5	0.0	0.0	0.0	6.1	6.4	8.3	13.0	101.5
Evapotranspiration	0.95	1.48	2.81	4.35	6.25	7.75	8.72	7.53	5.28	3.21	1.55	0.96	50.82

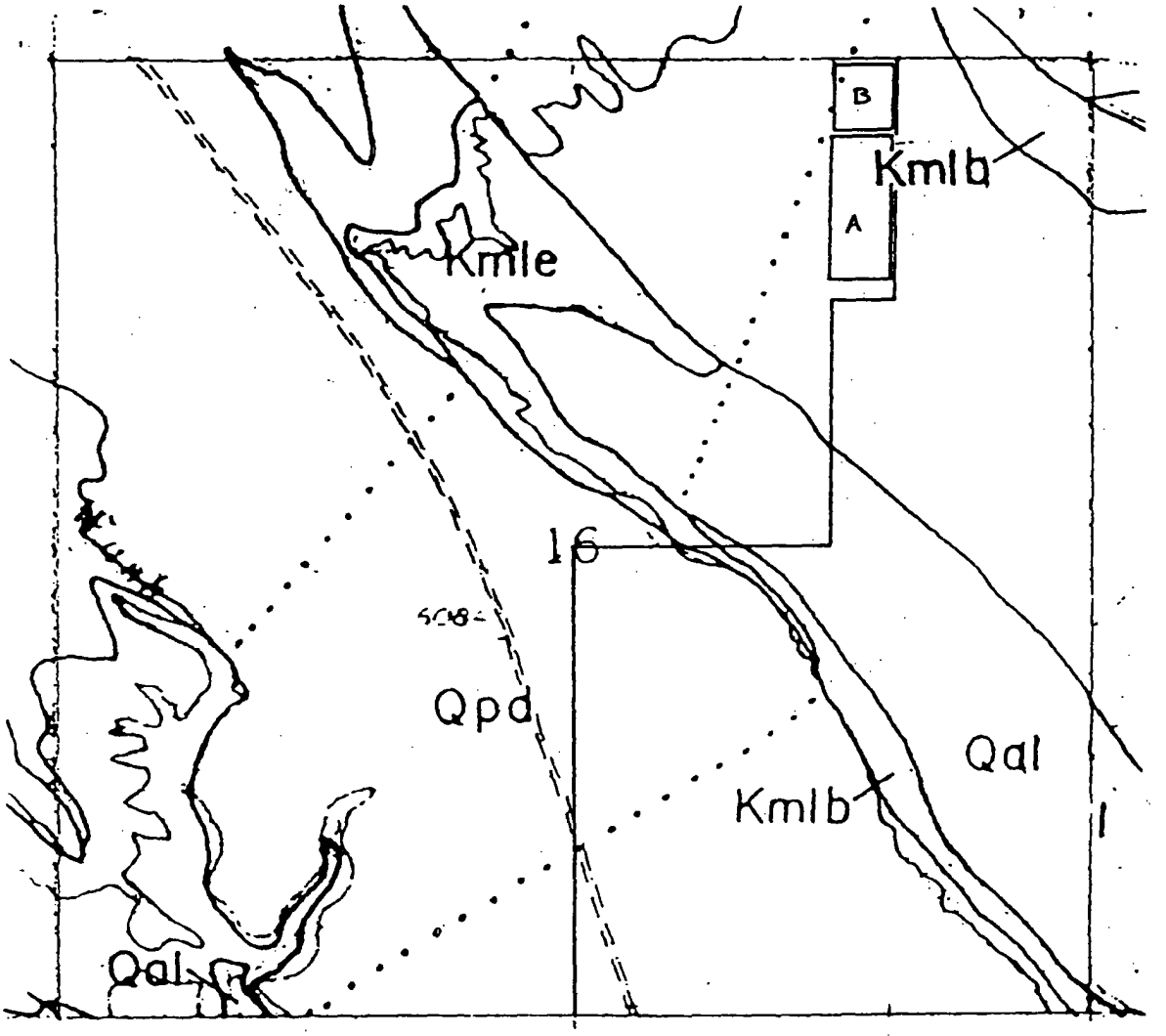
*Percentage of period with data: 97% for temperature, 99% for precipitation, 97% for snowfall.

Castle Dale

County: Emery Latitude: 39°12' Longitude: 111°01' Elevation: 5619 feet Period: 1928-1992*

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Normal max temp	35.8	42.9	53.2	63.1	73.1	83.9	89.6	86.9	78.8	66.9	50.7	38.6	63.6
Normal min temp	7.6	14.5	23.3	30.4	38.9	46.9	53.8	51.4	42.3	32.0	21.6	11.3	31.2
Normal mean temp	21.7	28.7	38.3	46.8	56.0	65.4	71.7	69.2	60.6	49.5	36.1	24.9	47.4
Record high temp	62	70	81	85	91	100	103	101	95	87	74	64	103
Record low temp	-34	-35	3	12	18	25	35	32	22	3	-7	-28	-35
Normal pcpn	0.56	0.48	0.56	0.50	0.66	0.46	0.83	0.99	0.76	0.74	0.48	0.52	7.52
Record mly pcpn	1.96	1.69	1.93	1.96	2.73	2.01	3.21	3.27	3.68	3.65	2.68	1.74	3.68
Record dly pcpn	0.73	1.10	0.95	0.92	1.07	1.09	1.43	1.35	1.39	1.24	1.49	0.96	1.49
Normal snowfall	6.6	3.8	1.7	0.6	0.0	0.0	0.0	0.0	0.0	0.2	1.3	3.8	18.0
Record mly snow	24.5	19.9	7.0	6.0	4.0	0.0	0.0	0.0	0.0	4.0	12.1	18.4	24.5
Record dly snow	10.5	8.0	7.0	6.0	4.0	0.0	0.0	0.0	0.0	4.0	7.0	9.5	10.5
Evapotranspiration	0.79	1.31	2.69	4.21	6.05	7.68	8.16	7.06	4.94	3.03	1.42	0.84	48.07

*Percentage of period with data: 91% for



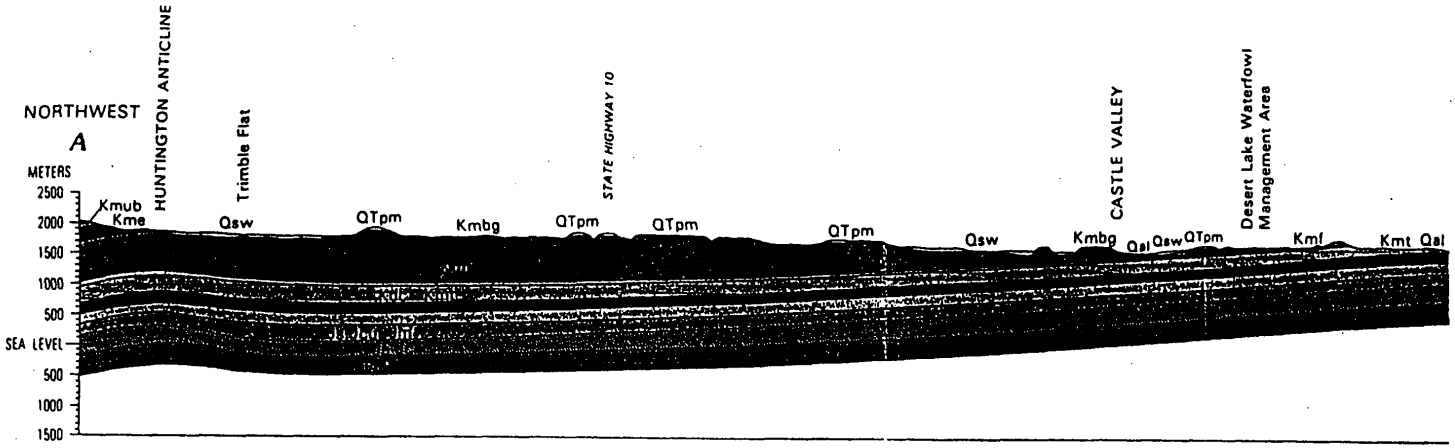
EMERY COUNTY LANDFILL
APPLICATION FOR A PERMIT TO OPERATE A CLASS I LANDFILL

FIGURE A Generalized Geologic Map of the Emery County Landfill
From Ellis and Frank, 1981.

Approximate Scale = 1:12,000 (one inch = 1,000 feet)
(Xerographically enlarged)

LEGEND

Qal Quaternary Alluvium--sand and gravel in wash channels
Qpd Quaternary Pediment Deposits--sand and gravel mantling ridge tops
Kmle Lower Part of Emery Sandstone Member of the Mancos Shale
Kmlb Lower Part of the Blue Gate Member of the Mancos Shale



EMERY COUNTY LANDFILL
APPLICATION FOR A PERMIT TO OPERATE A CLASS I LANDFILL

FIGURE B Geological Cross Section of Castle Valley
Showing Regional Extent of the Blue Gate Member of the Mancos Shale
From Witkind, 1988.

Bearing: North 67 degrees West

Vertical and Horizontal Scales = 1:100,000

LEGEND

Qsw Quaternary Sand in washes
QTpm Quaternary and Late Tertiary Pediment sand and gravel
Kme Emery Sandstone Member of the Mancos Shale
Kmbg Blue Gate Member of the Mancos Shale
Kmf Ferron Sandstone Member of the Mancos Shale

SOUTHERN UTAH UNIVERSITY TESTING LAB
SCIENCE BLDG. - ROOM 206
351 WEST CENTER
CEDAR CITY, UT 84720

SAMPLE NUMBER : K0950492 COST : 103.00

TIME COLLECTED : DATE COLLECTED : 6-2-95

DATE RECIVED : 2-JUN-1995

DATE COMPLETED : 14-JUN-1995 DATE SENT :

INVOICE NUMBER :

COLLECTOR : C PRAVETTE

SITE LOCATION : E.C.L.1

SEND RESULTS TO : TAHOMA
444 S MAIN SUITE C7
CEDAR CITY, UT 84720

ALL RESULTS IN MILLIGRAMS/LITER (ppm)

ANIONS	CATIONS	CATIONS	GEN PRAM	OXYGEN	CHECKS
339.9 BICAR		* 3.40 Fe-T			
1. CO3					
18781.7 Cl			44200. COND		
		174.0 Mg	1486.0 HARD		
		* 0.060 Mn			
			7.7 PH		
< 1.00 OH					
		84.50 K			
	308.3 Ca	0.020 Se			
		* 13110.0 Na			
			* 38400. TDS		
364.4 SO4					
< 0.10 NO3/2					

NOTES :

State of Utah
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt
Governor
Dianne R. Nielson, Ph.D.
Executive Director
Dennis R. Downs
Director

288 North 1460 West
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February 29, 1996

MAR 0 - 1996

Commissioner Bevan Wilson
Emery County
P. O. Box 629
Castle Dale, Utah 84513

Subject: Emery County Landfill (#9427) Request for Ground Water Monitoring, Liner, and Leachate Collection Exemption

Dear Commissioner Wilson:

The *Utah Solid Waste Permitting and Management Rules* (Rule) require municipal landfills, which receive over 20 tons of solid waste per day, to have a ground water monitoring system and the disposal cells to include a composite liner with a leachate collection system. However, these requirements may be suspended by the Executive Secretary of the Solid and Hazardous Waste Control Board if a demonstration can be made that meets the conditions of Section R315-308-1 and Section R315-303-4(3) of the Rule.

Section R315-308-1. Ground Water Monitoring Requirements

(3) Ground water monitoring requirements may be suspended by the Executive Secretary if the owner or operator of a solid waste disposal facility can demonstrate that there is no potential for migration of hazardous constituents from the facility to the ground water during the active life of the facility and the post-closure care period. This demonstration must be certified by a qualified ground water scientist and approved by the Executive Secretary, and must be based upon:

(a) site-specific field collected measurements, sampling, and analysis of physical, chemical, and biological processes affecting contaminant fate and transport; and

(b) contaminant fate and transport predictions that maximize contaminant migration and consider impacts on human health and the environment.

Section R315-303-4(3(c)). Equivalent Design

(i) The owner or operator may use, as approved by the Executive Secretary, alternative design, operating practices, and location characteristics which will minimize the migration of solid waste constituents or leachate into the ground or surface water which are at least as effective as the liners of Subsections R315-303-4(3)(a) or (b);

(ii) The owner or operator must demonstrate that the standard of Subsection R315-303-3(1) can be met. The demonstration must be approved by the Executive Secretary, and must be based upon:

(A) the hydrogeologic characteristics of the facility and the surrounding land;

(B) the climatic factors of the area;

(C) the volume and physical and chemical characteristics of the leachate; and

(D) predictions of contaminate fate and transport in the subsurface that maximize contaminant migration and consider impacts on human health and the environment;

The design and operational plan for the Emery County Landfill will be based on the determination of whether or not groundwater monitoring, liner, and leachate collection will be required. Therefore, it would be helpful for the Division to make an early determination of whether the exemption is likely to be approved.

Emery County's consultant, Tahoma Companies, has submitted a request for a exemption from the ground water monitoring, liner, and leachate collection system. Tahoma Companies has also submitted additional supportive information on separate occasions. Attached is the review of the *Response to Request for Additional Information* which was submitted September 26, 1995.

The final determination of the groundwater monitoring suspension and alternative design request can only be made with the issuance of a permit. A permit is issued only after all permit application information has been reviewed, the opportunity for public comment has been presented, and the entire permitting process has been completed. However, based on the initial information submitted, it is anticipated that the Emery County Landfill may be granted a permit that will incorporate the suspension of the groundwater monitoring requirement and the approval of the alternative no liner design. The anticipated approval assumes that no conflicting information becomes evident during the permitting process, and the plan of operation and the closure plan ensure that the development and migration of leachate are minimized.

If you have questions or need further information, please contact Ralph Bohn or Jeff Emmons at 801-538-6170.

Sincerely,

Dennis R. Downs, Director
Division of Solid and Hazardous Waste

enclosure (2)

c: David Cunningham, B.S.N., R.N., Health Officer/Dept. Director, Southeastern Utah District Health Department
David Ariotti, DEQ District Engineer
Rex Funk, Emery County Landfill Manager
Gary Player, Tahoma Companies, Inc.

DRD/JTE/sm

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File: Emery County Landfill #9427

EMERY COUNTY CLASS I LANDFILL
REQUEST FOR GROUND WATER MONITORING, LINER, AND LEACHATE COLLECTION EXEMPTION

Review of Additional Information #2 Submitted by Tahoma Companies

February 29, 1996

HELP MODEL COMMENTS

The HELP model can be used to predict the amount of leachate that will pass through bottom of the landfill cell. To make the required exemption demonstration, Tahoma Companies used conservative assumptions in the HELP Model and the performance evaluation of the landfill.

Final Cover Thickness

HELP model runs were conducted to make a performance comparison of two landfill closure cap designs. The first design consisted of 18 inches of low permeable soils covered with 6 inches of soil capable of sustaining vegetative growth. The second design consisted of 18 inches of low permeable soils covered with 40 inches of soil capable of sustaining vegetative growth. Tahoma Companies conclusion, based on the comparison from the two designs, is that "an increased vegetative layer would not improve the performance of the landfill". However, the HELP model does not accurately predict the impact on the low permeable soil from frost damage, plant root channeling, and desiccation. A top soil layer of six inches will not sufficiently protect the integrity of the low permeable soil layer.

The *Engineering Document for Version 3* of the HELP Model explains on page 108 that,

> *The HELP program assumes Darcian flow for vertical drainage through homogeneous, temporally uniform soil and waste layers. It does not consider preferential flow through channels such as cracks, root holes, or animal burrows. As such, the program will tend to overestimate the storage of water during the early part of the simulation and overestimate the time required for leachate to be generated.*

Another model run was conducted to specifically show the effects of freezing of low permeable layer in the landfill cap. The hydraulic conductivity was increased to replicate increased moisture through the cap as a result of frost damage. However, increasing the hydraulic conductivity of the lower permeable layer in the model simulation results in a ***uniformly*** higher permeability for the material, rather than the cracks and channels that would result from freezing. As stated above, the model can not simulate the preferential flow through cracks and channels.

In summary, the integrity of the low permeable final cover layer must be preserved to minimize infiltration of water. This can only be accomplished by covering the low permeable layer with a soil layer with a thickness that equals or exceeds the depth of penetration of roots, desiccation, and frost. The Utah Department of Transportation (UDOT) has estimated that the maximum frost penetration depth at the landfill site is between 40 and 50 inches. Enclosed is formula used by UDOT to determine maximum frost depth and the map showing frost depth at the Emery County Landfill. It may be useful to use the UDOT formula to determine the site specific maximum frost penetration depth. If the UDOT map is solely used in the design criteria for the landfill cover, 50 inches of cover soil must be provided above the lower permeable soil.

Hydraulic Conductivity of Lower Permeable Cover Layer

The output from the 20-years closed HELP model run was included with the last submittal. The low permeable soil layer (layer 2) consisted of a silty clay (soil type 12) which has a hydraulic conductivity of 4.2×10^{-5} cm/sec . This hydraulic conductivity provides a conservative estimate of leachate generation and is appropriate for computer modeling. However, it needs to be noted that a hydraulic conductivity of 1×10^{-5} cm/sec or less is required in the landfill cover design.

Time of Travel Calculations

The time of travel calculations, included in the submittal, provides an estimate of how long it would take leachate to move through the Mancos Shale and reach first ground water. The time of travel formula uses the percolation rate as an equivalent to hydraulic conductivities. Although these two term are not equivalent, this time of travel measurement appears to be a conservative assumption. Ideally, the unsaturated hydraulic conductivity would be the most appropriate to use in the calculation. The unsaturated hydraulic conductivity, as calculated in the February 26, 1996, submittal, is several orders of magnitude less than the saturated hydraulic conductivity.

Landfill Equilibrium

The long-term leachate production rate is reached in the landfill model when the change in water storage of the landfill mass stabilizes near zero. The Division incorrectly asked Tahoma Companies to extend the Help model runs until equilibrium is reached or when the water budget balance equals zero. The submitted model run showed the landfill reach the water budget balance of near zero almost immediately. Using the data files contained in the submittal, the closed landfill model run was extended to 25 years. At the end of 25 years the landfill was producing less than 0.019 inches of leachate per year and was approaching equilibrium.

TAHOMA COMPANIES, INCORPORATED ❖ WDBE
444 South Main Street, Suite C-7, Cedar City, Utah 84720 ☎ (801) 865-0131 fax 865-0161

February 26, 1996

FILE COPY

Mr. Jeff Emmons
Environmental Scientist
Utah Division of Solid and Hazardous Waste
P.O. Box 144880
Salt Lake City, Utah 84114-4880

Dear Jeff:

This letter will further clarify our conclusion that there is no potential for migration of hazardous constituents from the Emery County Landfill to ground water during the active life of the landfill and the post-closure care period.

In a letter to Box Elder County dated January 29, 1996, Mr. Phil Burns of the Utah Division of Solid and Hazardous stated that:

> "this (leachate) percolation rate is still probably one of the limiting factors in the potential for ground water contamination."

In our opinion, the leachate percolation rate is **the** most important limiting factor.

The HELP program simulates daily water movement into, through and out of a landfill. Surface and subsurface processes are modeled. The surface processes modeled are snowmelt, interception of rainfall by vegetation, surface runoff, and evaporation of water, interception and snow from the surface. The subsurface processes modeled are evaporation of water from the soil, plant transpiration, vertical unsaturated drainage, geomembrane liner leakage, and barrier soil liner percolation (not applicable in this case, as no liner was included in model runs), and lateral saturated drainage. In summary, the HELP program considers all sources of water when calculating a percolation rate for the leachate.

Any percolating leachate will descend vertically in unsaturated materials for at least 140 feet, as there are no aquifers present beneath the landfill site in that distance to deflect the flow. Unsaturated hydraulic conductivity in the fractured Mancos Shale underlying the Emery County Landfill has been calculated to be about 15 orders of magnitude less than saturated hydraulic conductivity in the same rocks using equations included in the *Engineering Documentation for Version 3* of the HELP model and in Maidment, ed., 1992. The calculations that substantiate these unsaturated hydraulic conductivity values are attached.

Unsaturated hydraulic conductivity of the naturally occurring soils will determine the rate at which leachate initially moves through the soils. This rate is substantially slower than the percolation of leachate out the bottom of the landfill. Once a partial column of soil becomes saturated with leachate,

the rate of leachate percolation through the natural soils will increase until percolation is limited by the quantity of leachate available. Percolation at the "leachate front" (the lowermost limit of leachate percolation) will then stabilize at a rate intermediate between the saturated and unsaturated hydraulic conductivities of the Mancos Shale.

The actual rate of infiltration into Mancos Shale is difficult to determine, but it will be somewhere between the unsaturated hydraulic conductivity (about 10^{-20} cm/second) and the saturated hydraulic conductivity (about $5 \dot{x} 10^{-5}$ cm/second) of the natural substrate. The HELP model predicts that only enough leachate will be generated by the landfill to provide moisture to the natural soils at the rate of about 4.2×10^{-9} cm/second (equivalent to .05 inches per year), and it is unlikely that leachate will saturate the uniformly layered natural soils any faster than it is generated by the landfill.

Sincerely,

Gary F. Player
Vice President and Principal Geologist

cc: Mr. Rex Funk
Elaine Forbes

K:\CLIENTS\93683-3\CORRES\UNSATHYC.LTR

TAHOMA COMPANIES, INCORPORATED							
for EMERY COUNTY, UTAH			EMERY COUNTY LANDFILL, CASTLE DALE, UTAH				
CALCULATIONS OF UNSATURATED HYDRAULIC CONDUCTIVITY							
REFERENCE: Campbell, G.S., 1974, *A Simple Method for Determining Unsaturated Hydraulic*							
Conductivity from Moisture Retention Data, Soil Science, Vol 117, No. 6, pp. 311-314.							
FOR FRACTURED MANCOS SHALE							
ACTUAL SOIL WATER CONTENT = SM =				0.015	VOL/VOL		
RESIDUAL SOIL WATER CONTENT = RS =				0.01	VOL/VOL		
SATURATED WATER CONTENT (POROSITY) = UL =				0.06	VOL/VOL	(EFFECTIVE)	
PORE SIZE DISTRIBUTION INDEX = LAMBDA =				0.165	DIMENSIONLESS		
Ks = SATURATED HYDRAULIC CONDUCTIVITY =				0.00005	CM/SEC	(MEASURED)	
Ku = UNSATURATED HYDRAULIC CONDUCTIVITY							
			Ku = Ks((SM-RS)/(UL-RS))^(3+2/LAMBDA)				
FOR MANCOS SHALE			Ku =	3.7823E-20	CM/SEC		
FOR SAND:							
ACTUAL SOIL WATER CONTENT = SM =				0.05	VOL/VOL		
RESIDUAL SOIL WATER CONTENT = RS =				0.02	VOL/VOL		
SATURATED WATER CONTENT (POROSITY) = UL =				0.437	VOL/VOL	(EFFECTIVE)	
PORE SIZE DISTRIBUTION INDEX = LAMBDA =				0.694	DIMENSIONLESS		
Ks = SATURATED HYDRAULIC CONDUCTIVITY =				0.03	CM/SEC	(MEASURED)	
Ku = UNSATURATED HYDRAULIC CONDUCTIVITY							
			Ku = Ks((SM-RS)/(UL-RS))^(3+2/LAMBDA)				
FOR SAND:			Ku =	5.6766E-09	CM/SEC		

State of Utah
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt
Governor
Dianne R. Nielson, Ph.D.
Executive Director
Dennis R. Downs
Director

288 North 1460 West
P.O. Box 144880
Salt Lake City, Utah 84114-4880
(801) 538-6170 Voice
(801) 538-6715 Fax
(801) 536-4414 T.D.D.

August 25, 1995

Commissioner Bevan Wilson
Emery County
P. O. Box 629
Castle Dale, Utah 84513

Subject: Emery County Landfill (#9427) Request for Ground Water Monitoring and Liner Exemption

Dear Commissioner Wilson:

I have reviewed the *Emery County Landfill Request for Exemption from Liner, Leachate Control, and Ground Water Monitoring*, prepared by Tahoma Companies Inc. As with any technical document review, I have some questions. The specific questions are contained in the enclosed *Request For Additional Information #2*. Two copies of the response to the *Request For Additional Information* #2, need to be submitted for review.

Exemptions from groundwater monitoring may be granted for disposal facilities that demonstrate there is no potential for migration of hazardous constituents from the facility to ground water. Exemptions from the use of a landfill liner requires a design which will minimize the migration of solid waste constituents or leachate into the ground water which is as least as effective as the one or more barrier layers with an effective hydraulic conductivity of 1×10^{-7} cm/sec. These requirements mandate the use of conservative assumptions in the exemptions.

I understand the landfill design contained in the *Emery County Landfill Application for a Permit to Operate A Class I Landfill*, will be significantly modified. The modification includes a size reduction of the next landfill cell; the separate construction/demolition waste cell will be eliminated; and the landfill bottom layer of crushed mancos shale will be eliminated. Therefore, references to the submitted application design should be eliminated from the *Request for Exemption from Liner, Leachate Control, and Ground Water Monitoring*. The request for exemptions should be a stand alone document. All the information required to complete the evaluation should be contained in the exemption request.

EMERY COUNTY CLASS I LANDFILL
REQUEST FOR GROUND WATER MONITORING, LINER, AND LEACHATE COLLECTION EXEMPTION

REQUEST FOR ADDITIONAL INFORMATION #2

August 25, 1995

To obtain an exemption from ground water monitoring, the owner of the landfill must demonstrate there is no potential for the migration of leachate to ground water. The no potential requirement mandates the use of conservative assumptions in the landfill evaluation. Following is the additional information requested to be included in the demonstration.

HELP MODEL GENERAL COMMENTS

Three model runs were provided in Appendix D of the exemption request. Each of the runs varied in their initial waste moisture content. The model incorporated a design that had a final cover over the waste. The design also used a bottom barrier layer that consisted of 52 inches of mancos shale with a hydraulic conductivity of 1×10^{-3}. 120

The Help model is designed for evaluation of liquid migration through soils, wastes, and synthetic liners. The HELP model was not designed to evaluate flow through fractured rock. Flow through fractures may be the most important component of flow through the rock.

1. Additional model runs should be made with the waste as the bottom-most layer. A time of travel analysis needs to be provided for the leachate generated.

The model runs should represent the actual or more conservative conditions at the landfill. The model runs should be of sufficient time to determine the equilibrium leachate generation rate. Equilibrium is reached when the water balance for each year is zero or consistently near zero.

2. Additional computer runs of sufficient years to reach equilibrium need to be submitted.

3. The model runs need to simulate the landfill operation. The model runs need to simulate the number of years the landfill cell is operated without a final cover and the years with a final cover.

4. The data files used in the computer runs, need to be included with the response to the request for additional information.

→ include a diskette with data files on submission

depth of two to four feet. The plant roots under the current design could penetrate the clay barrier and drastically reduce its ability to retard moisture from entering the landfill. Channeling due to root penetration can be accounted in the model by selecting different soil textures or by selecting different default soil textures. Default soil textures result in the root channeling adjustments for only the top half of the evaporative zone. Increasing the thickness of the cover materials can also ensure the integrity of the cap.

Two other climatic conditions may jeopardize the integrity of the clay cover. The frost depth and the evapotranspiration depth on-site may increase the moisture flow through the clay barrier.

8. The landfill cover design needs to address the concerns of root depth, frost depth, and evapotranspiration depth. If a different cap design is needed, it should be reflected in the data files.

9. For each layer in the landfill design, a discussion needs to be provided for each data input selected. Those inputs include:
   * Layer Classification (Vertical percolation, Lateral drainage, barrier soil/liners)
   * Soil texture number, total porosity, field capacity, wilting point, initial moisture

DEPTH TO GROUND WATER

Page 9 of the exemption request states:

> *A few drops of vadose zone water were encountered in drill cuttings at about 140 feet BGL. A small amount of this water (less than 10 gallons) accumulated in the boring over night after the hole had been advanced to 180 feet on May 30, 1995.*

Section 301-2(27) defines ground water as subsurface water which is in the zone of saturation including perched ground water. Saturated zones will release water to a bore hole.

10. What is the rational for assuming the water encountered at 140 feet is vadose zone water?

MANCOS SHALE AS A LEACHATE MIGRATION BARRIER

The exemption request summary and conclusion states on page 18:

> ***The Emery County Landfill site has a safe natural setting that would protect ground water in the unlikely event of leachate generation. Relatively impermeable shales under the site are more than 3,000 feet thick.***

The only site specific measurements were the fracture porosity and hydraulic conductivity at the surface of the mancos shale. The resulting fracture porosity of 4% and a hydraulic conductivity of 1×10^{-3} cm/s are expected to be representative of the shale at increased depths. The exemption request also refers to a published report by David Snow.

minimize the migration of solid waste constituents or leachate into the ground or surface water..... are at least as effective as the liners.

.....[ground water monitoring may be suspended if there is] *no potential for migration of hazardous constituents from the facility to ground water during the active life of the facility and post-closure care period.*

In summary, to make the above demonstrations, the exemption requests needs to provide the following:

* Additional HELP Model simulations which incorporate different assumptions and which provide expanded discussions of the rational for selecting the model input data.

* Additional site specific data or other documentation to support the assumption that the mancos shale underlying the landfill will protect groundwater. The documentation needs to include time of travel calculation for the migration of the leachate generated.

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File: Emery County Class I Landfill #9427

APPENDIX F

TAHOMA COMPANIES, INCORPORATED WDBE
444 S. MAIN STREET, SUITE C-7
CEDAR CITY, UTAH 84720
(801) 865 0131 FAX (801) 865 0161

April 5, 1994

Mr. Tom Gnojek
U.S. Bureau of Land Management
San Rafael River Resource Area
900 North 700 East
Price, Utah 84501

Dear Mr. Gnojek:

Thank you for your useful advice on wilderness and recreation land issues associated with landfill licensing given in our telephone conversation of Tuesday morning, April 5, 1994.

You and I briefly discussed the Emery County Landfill (ECL) near Castle Dale, Utah. The ECL is located on the western edge of Wilberg Flat in section 16, T. 18 S., R. 8 E., SLB&M. The landfill has been operating since 1984, but must now be licensed under new state regulations effective September, 1993. The area to be licensed is within a fenced, disturbed area, adjacent to an operating landfill cell.

You informed me that the ECL is not located within a designated wilderness or wilderness study area. You also assured me that the only wilderness or WSA in Emery County is east of Highway 10.

It is our opinion that the ECL will not impact wilderness or recreation areas.

Thanks again for the prompt advice from your agency. Tahoma Companies will soon be involved in license applications for several other Utah landfills. It is nice to know where we can get help on wilderness area issues so readily.

Sincerely,

Gary F. Player
Principal Geologist

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Emergency location Stand.

TAHOMA COMPANIES, INCORPORATED WDBE
444 S. MAIN STREET, SUITE C-7
CEDAR CITY, UTAH 84720
(801) 865 0131 FAX (801) 865 0161

March 31, 1994

USFW 524 5001.

Mr. Robert Williams
U.S. Fish and Wildlife Service
2060 Administration Building
1745 West 1700 South
Salt Lake City, Utah 84104

Dear Mr. Williams:

Please thank Mr. Clark D. Johnson for his useful advice on Threatened and Endangered Species issues associated with landfill licensing given on Tuesday afternoon, March 29, 1994. At his suggestion, I have reviewed the USFWS list of Endangered, Threatened and Candidate Species in Utah by Latilong Block, dated September 24, 1992.

Clark and I briefly discussed the Emery County Landfill (ECL) near Castle Dale, Utah. The ECL is located on the western edge of Wilberg Flat in section 16, T. 18 S., R. 8 E., SLB&M. The landfill has been operating since 1984, but must now be licensed under new state regulations effective September, 1993. The area to be licensed is within a fenced, disturbed area, adjacent to an operating landfill cell.

Mr. Johnson informed me that the ECL is not located within a designated Critical Habitat Zone for any terrestrial species. He assured me that the only critical habitat officially recognized in Emery County is aquatic habitat identified for the Colorado River squawfish and the associated native fish community in most drainages of the Colorado, Green and San Juan river basins.

It is our opinion that the ECL will not impact aquatic habitats for the following reasons:

(1) The lands have been previously disturbed by old landfill operations; and

(2) No water courses or impoundments occur on the property.

At Mr. Clark's suggestion, I also contacted Mr. Larry England of your staff for further information on endangered, threatened and candidate plant species in Emery County. He (Mr. England) told me that critical habitat for listed or candidate plant species is not present at the Emery County Landfill.

Thanks again for the prompt advice from your agency personnel. Tahoma Companies will soon be involved in license applications for several other Utah landfills. It is nice to know where we can get help on biological issues so readily.

Sincerely,

Gary F. Player
Principal Geologist

Enclosure: Topographic Map of Emery County Landfill site.

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TAHOMA COMPANIES, INCORPORATED WDBE
444 S. MAIN STREET, SUITE C-7
CEDAR CITY, UTAH 84720
(801) 865 0131 FAX (801) 865 0161

March 30, 1994

Mr. Kyle "Jake" Jacobson
Utah Department of Agriculture
350 North Redwood Road
Salt Lake City, Utah 84116

Dear Jake:

Thank you for our beneficial discussion of Important Farmland issues associated with landfill licensing yesterday afternoon. At your suggestion, I have reviewed Utah Agricultural Experiment Station Research Report Number 76, "Important Farmlands of parts of Carbon, Emery, Grand and Sevier Counties." I have concluded that no classified "Important Farmlands" are present at the Emery County Landfill.

We briefly discussed the Emery County Landfill (ECL) near Castle Dale, Utah. The ECL is located on the western edge of Wilberg Flat in section 16, T. 18 S., R. 8 E., SLB&M. The landfill has been operating since 1984, but must now be licensed under new state regulations effective September, 1993. The area to be licensed is within a fenced, disturbed area, adjacent to an operating landfill cell.

Thank you again for a very productive meeting.

Sincerely,

Gary F. Player
Principal Geologist

Enclosure: Topographic Map of Emery County Landfill site.

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State of Utah

Department of Community & Economic Development
Division of State History
Utah State Historical Society

Michael O. Leavitt
Governor
Max J. Evans
Director

300 Rio Grande
Salt Lake City, Utah 84101-1182
(801) 533-3500
FAX: (801) 533-3503

April 12, 1994

Gary F. Player
Principal Geologist
Tahoma Companies, Incorporated WDBE
444 South Main Street, Suite C-7
Cedar City, Utah 84720

RE: Emery County Landfill (ECL)

In Reply Please Refer to Case No. 94-0450

Dear Mr. Player:

The Utah State Historical Preservation Office received the above referenced project on April 4, 1994. After review of the material provided, the Utah Preservation Office recommends that there would be **No Effect** upon cultural resources by the project.

If you have questions, please contact me at (801) 533-3555.

Sincerely,

Janice Reed Campbell for

James L. Dykmann
Compliance Archaeologist

JLD:94-0450 OR/NP/NE

TAHOMA COMPANIES, INCORPORATED WDBE
444 S. MAIN STREET, SUITE C-7
CEDAR CITY, UTAH 84720
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March 30, 1994

Mr. Jim Dykmann
Compliance Archaeologist
Utah Division of State History
300 Rio Grande
Salt Lake City, Utah 84101-1182

Dear Jim:

Thank you for our beneficial discussion of archaeological issues associated with landfills this morning. At your suggestion, I am requesting a consultation with your Division for the Emery County Landfill (ECL) near Castle Dale, Utah.

The ECL is located on the western edge of Wilberg Flat in section 16, T. 18 S., R. 8 E., SLB&M. The landfill has been operating since 1984, but must now be licensed under new state regulations effective September, 1993. The area to be licensed is within a fenced, disturbed area, adjacent to an operating landfill cell.

It is my opinion that this area will not require a field site archaeological clearance for the following reasons:

(1) The lands have been disturbed by old landfill operations;

(2) No water courses or impoundments occur on the property; and

(3) No registered Historic Places have been identified within a mile of the landfill site.

I look forward to your comments on this site.

Sincerely,

Gary F. Player
Principal Geologist

Enclosure: Topographic Map of Emery County Landfill site.
File:TT&A\license\shpoletr

TAHOMA COMPANIES, INCORPORATED
444 S. MAIN STREET, SUITE C-7
CEDAR CITY, UTAH 84720
(801) 865 0131 FAX (801) 865 0161

April 11, 1944

Mr. Dave Rodda
Aviation Safety Inspector
Federal Aviation Agency
116 N 2400 W
Salt Lake City, Utah 84116

Dear Mr. Rodda:

Thanks for your help in our efforts to obtain a license for the Emery County Landfill under new Utah state regulations. We spoke on the telephone a couple of weeks ago.

You and I briefly discussed the Emery County Landfill (ECL) near Castle Dale, Utah. The ECL is located on the western edge of Wilberg Flat in section 16, T. 18 S., R. 8 E., SLB&M. The landfill has been operating since 1984, but must now be licensed under new state regulations effective September, 1993. The area to be licensed is within a fenced, disturbed area, adjacent to an operating landfill cell.

After I told you the location of the landfill you provided me with the following information:

> The facility is not within ten thousand feet of any airport runway end used by turbojet aircraft or within 5,000 feet of any airport runway end used only by piston-type aircraft. The northeast end of an unimproved dirt landing strip on Danish Bench is 5,000 feet southeast from the currently operating cell of the landfill. The following is known about the dirt strip:
>
> > (1) The dirt landing strip is not listed by the FAA as either a public or a private airport; and
> >
> > (2) The dirt strip is not shown on current editions of the Las Vegas and Denver Sectional Aeronautical Charts published by the Federal Aviation Agency.

In Tahoma's opinion the dirt ~~strip~~ landing strip has been abandoned.

o O o

Thanks again for the prompt advice from your agency. Tahoma Companies will soon be involved in license applications for several other Utah landfills. It is nice to know where we can get help on aviation issues so readily.

Sincerely,

Gary Farnsworth Player
Principal Geologist
Registered California Geologist No. 4984
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APPENDIX G


Color files not supported e:/rware/dshw/data/General_Lib_FR/image/fr2817/SW200600_2517141

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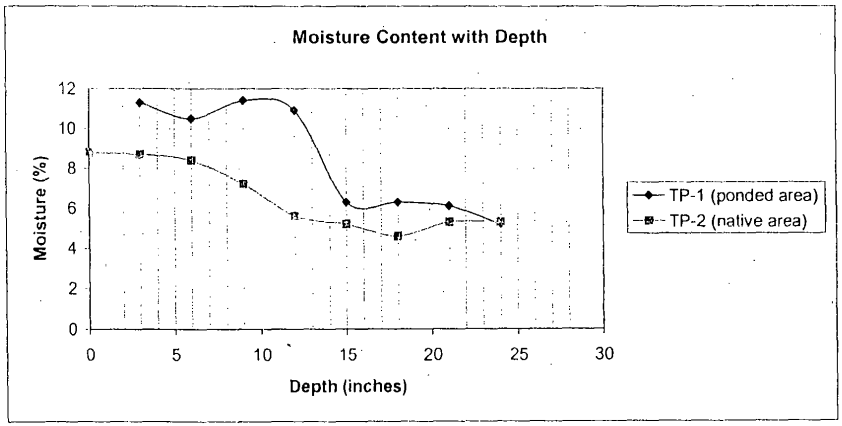
APPENDIX H

SUMMARY OF LABORATORY TEST RESULTS

Emery County Landfill Permit and Final Cover - 2003

Sample	Classification	Max. DD	OPT. %M	LL	PI	% - 200 Sieve	% -No. 4	Field Cap.	Wilting Pt.	Permeability
Cover No. 1	CL w/ Sand	125.4	11.5	32	19	58.9	72.3	35.5	17	7.90E-08
Liner No. 1	CL w/ Sand	122	12	28	10	62.5	94.9			2.38E-06
Liner No. 2	CL w/ Sand	121.5	12	27	9	63	94.9			1.29E-07
Borrow No. 1 (Southwest Borrow Slope - 1/14/03)	Shale	126.1	11.3	34	15			37.8	17.9	
Borrow No. 2 (Existing Stockpile - 1/14/03)	Shale	124.5	11.2	31	14			34.4	16.9	
Borrow No. 3 (South Central Borrow Slope - 1/14/03)	Shale	125.4	11.6	36	16			37.2	19.3	
Borrow No. 4 (Excvation for Cells 5 through 7)	Shale	127.8	9.8	29	12			30.5	13.2	
AVERAGE	ALL							35.1	16.9	

Moisture Content with Depth		
Sample	Depth	% Moisture
TP-1 (ponded area)	3	11.3
TP-1	6	10.5
TP-1	9	11.4
TP-1	12	10.9
TP-1	15	6.3
TP-1	18	6.3
TP-1	21	6.1
TP-1	24	5.2
TP-2 (native area)	0	8.8
TP-2	3	8.7
TP-2	6	8.4
TP-2	9	7.2
TP-2	12	5.6
TP-2	15	5.2
TP-2	18	4.6
TP-2	21	5.3
TP-2	24	5.3



APPENDIX

I

Annual cycle of precipation-evapotranspiration-storage for Emery County Landfill (1980 x 3)

Average Annual ave Precip total =	8.4	inches (average annual over last 100 years)
Average Annual Evapo-Transpiration =	44.5	inches (including sublimation)
Field Capacity of Cover Soil =	35.1	% (Moisture Content in Percent of Volume)
Wilting Point of Soil =	16.9	% (Moisture Content in Percent of Volume)
Runoff =	0	% (Percent of Precipation)
Initial Moisture Content of Cover Soil =	20	% (Percent of Volume)
Thickness of Cover Soil =	24	inches
Penman-Wilson ET Reduction =	0.6	(fraction of total potential evapo-transpiration expressed as actual soil evaporation)
Maximum Storage Capacity of Cover Soil =	4.37	inches [(field capacity - wilting point) x layer thickness]
Initial Storage Capacity =	3.62	inches

45.14

YEAR	Day of the Year	Available Storage Capacity (in.)	Daily Precipitation (in.)	Daily Infiltration (in.)	Daily ET (in.)	Actual ET (in.)	Change in Storage (in.)	Ending Storage (in.)	Percolation	Sum of Yearly Percolation (in.)	
1980	1	3.62	0	0.00	0.0130	0.01	0.01	3.63	none	1	0.000
	2	3.63	0	0.00	0.0165	0.01	0.01	3.64	none	2	0.000
	3	3.64	0	0.00	0.0173	0.01	0.01	3.65	none	3	0.000
	4	3.65	0	0.00	0.0102	0.01	0.01	3.66	none		
	5	3.66	0	0.00	0.0102	0.01	0.01	3.66	none		
	6	3.66	0	0.00	0.0106	0.01	0.01	3.67	none		
	7	3.67	0	0.00	0.0248	0.01	0.01	3.69	none		
	8	3.69	0	0.00	0.0319	0.02	0.02	3.70	none		
	9	3.70	0	0.00	0.0406	0.02	0.02	3.73	none		
	10	3.73	0.27	0.27	0.0351	0.02	-0.25	3.48	none		
	11	3.48	0.06	0.06	0.0343	0.02	-0.04	3.44	none		
	12	3.44	0.18	0.18	0.0130	0.01	-0.17	3.27	none		
	13	3.27	0.13	0.13	0.0193	0.01	-0.12	3.15	none		
	14	3.15	0.02	0.02	0.0244	0.01	-0.01	3.14	none		
	15	3.14	0	0.00	0.0370	0.02	0.02	3.17	none		
	16	3.17	0	0.00	0.0390	0.02	0.02	3.19	none		
	17	3.19	0	0.00	0.0197	0.01	0.01	3.20	none		
	18	3.20	0.69	0.69	0.0232	0.01	-0.68	2.52	none		
	19	2.52	0.39	0.39	0.0327	0.02	-0.37	2.15	none		
	20	2.15	0	0.00	0.0307	0.02	0.02	2.17	none		
	21	2.17	0	0.00	0.0323	0.02	0.02	2.19	none		
	22	2.19	0	0.00	0.0339	0.02	0.02	2.21	none		
	23	2.21	0	0.00	0.0303	0.02	0.02	2.23	none		
	24	2.23	0	0.00	0.0267	0.02	0.02	2.25	none		
	25	2.25	0	0.00	0.0358	0.02	0.02	2.27	none		
	26	2.27	0	0.00	0.0402	0.02	0.02	2.29	none		
	27	2.29	0	0.00	0.0409	0.02	0.02	2.32	none		
	28	2.32	0	0.00	0.0406	0.02	0.02	2.34	none		
	29	2.34	0.51	0.51	0.0256	0.02	-0.49	1.85	none		
	30	1.85	0.19	0.19	0.0425	0.03	-0.16	1.68	none		
	31	1.68	0	0.00	0.0291	0.02	0.02	1.70	none		
	32	1.70	0	0.00	0.0343	0.02	0.02	1.72	none		
	33	1.72	0	0.00	0.0358	0.02	0.02	1.74	none		
	34	1.74	0	0.00	0.0378	0.02	0.02	1.77	none		
	35	1.77	0	0.00	0.0382	0.02	0.02	1.79	none		
	36	1.79	0	0.00	0.0496	0.03	0.03	1.82	none		
	37	1.82	0	0.00	0.0408	0.02	0.02	1.84	none		
	38	1.84	0	0.00	0.0421	0.03	0.03	1.87	none		
	39	1.87	0	0.00	0.0327	0.02	0.02	1.89	none		
	40	1.89	0	0.00	0.0335	0.02	0.02	1.91	none		
	41	1.91	0	0.00	0.0339	0.02	0.02	1.93	none		
	42	1.93	0	0.00	0.0315	0.02	0.02	1.95	none		
	43	1.95	0	0.00	0.0386	0.02	0.02	1.97	none		
	44	1.97	0	0.00	0.0390	0.02	0.02	1.99	none		
	45	1.99	0.08	0.08	0.0441	0.03	-0.05	1.94	none		
	46	1.94	0.36	0.36	0.0272	0.02	-0.34	1.60	none		
	47	1.60	0.02	0.02	0.0449	0.03	0.01	1.60	none		
	48	1.60	0.14	0.14	0.0539	0.03	-0.11	1.50	none		
	49	1.50	0.1	0.10	0.0429	0.03	-0.07	1.42	none		
	50	1.42	0.43	0.43	0.0607	0.04	-0.39	1.03	none		
	51	1.03	0.36	0.36	0.0386	0.02	-0.34	0.70	none		
	52	0.70	0.05	0.05	0.0543	0.03	-0.02	0.68	none		
	53	0.68	0.24	0.24	0.0280	0.02	-0.22	0.46	none		
	54	0.46	0.02	0.02	0.0610	0.04	0.02	0.47	none		
	55	0.47	0	0.00	0.0516	0.03	0.03	0.50	none		
	56	0.50	0	0.00	0.0539	0.03	0.03	0.54	none		
	57	0.54	0	0.00	0.0587	0.04	0.04	0.57	none		
	58	0.57	0	0.00	0.0701	0.04	0.04	0.61	none		
	59	0.61	0	0.00	0.0752	0.05	0.05	0.66	none		
	60	0.66	0	0.00	0.0732	0.04	0.04	0.70	none		
	61	0.70	0	0.00	0.0654	0.04	0.04	0.74	none		
	62	0.74	0	0.00	0.0685	0.04	0.04	0.78	none		
	63	0.78	0	0.00	0.0681	0.04	0.04	0.82	none		
	64	0.82	0	0.00	0.0697	0.04	0.04	0.86	none		
	65	0.86	0	0.00	0.0713	0.04	0.04	0.91	none		
	66	0.91	0.02	0.02	0.0646	0.04	0.02	0.93	none		
	67	0.93	0.93	0.93	0.0520	0.03	-0.90	0.03	none		
	68	0.03	0	0.00	0.0921	0.06	0.06	0.08	none		
	69	0.08	0	0.00	0.0669	0.04	0.04	0.12	none		
	70	0.12	0	0.00	0.0634	0.04	0.04	0.16	none		
	71	0.16	0.08	0.08	0.0728	0.04	-0.04	0.12	none		
	72	0.12	0	0.00	0.0689	0.04	0.04	0.17	none		
	73	0.17	0	0.00	0.0512	0.03	0.03	0.20	none		
	74	0.20	0	0.00	0.0799	0.05	0.05	0.24	none		
	75	0.24	0	0.00	0.0929	0.06	0.06	0.30	none		
	76	0.30	0	0.00	0.1020	0.06	0.06	0.36	none		
	77	0.36	0	0.00	0.0457	0.03	0.03	0.39	none		
	78	0.39	0	0.00	0.0657	0.04	0.04	0.43	none		
	79	0.43	0	0.00	0.0803	0.05	0.05	0.48	none		
	80	0.48	0	0.00	0.0894	0.05	0.05	0.53	none		
	81	0.53	0	0.00	0.0972	0.06	0.06	0.59	none		
	82	0.59	0	0.00	0.0882	0.05	0.05	0.64	none		
	83	0.64	0.15	0.15	0.0583	0.03	-0.12	0.53	none		
	84	0.53	0	0.00	0.0846	0.05	0.05	0.58	none		

85	0.58	0.02	0.02	0.0732	0.04	0.02	0.60	none
86	0.60	0	0.00	0.0657	0.04	0.04	0.64	none
87	0.64	0	0.00	0.0717	0.04	0.04	0.68	none
88	0.68	0	0.00	0.0780	0.05	0.05	0.73	none
89	0.73	0	0.00	0.0772	0.05	0.05	0.78	none
90	0.78	0	0.00	0.0874	0.05	0.05	0.83	none
91	0.83	0	0.00	0.0654	0.04	0.04	0.87	none
92	0.87	0.03	0.03	0.0492	0.03	0.00	0.87	none
93	0.87	0	0.00	0.0736	0.04	0.04	0.91	none
94	0.91	0	0.00	0.0783	0.05	0.05	0.96	none
95	0.96	0	0.00	0.0839	0.05	0.05	1.01	none
96	1.01	0	0.00	0.1138	0.07	0.07	1.08	none
97	1.08	0	0.00	0.1267	0.08	0.08	1.15	none
98	1.15	0	0.00	0.1161	0.07	0.07	1.22	none
99	1.22	0	0.00	0.0732	0.04	0.04	1.27	none
100	1.27	0	0.00	0.1079	0.06	0.06	1.33	none
101	1.33	0	0.00	0.1413	0.08	0.08	1.42	none
102	1.42	0	0.00	0.1122	0.07	0.07	1.49	none
103	1.49	0	0.00	0.0909	0.05	0.05	1.54	none
104	1.54	0	0.00	0.1008	0.06	0.06	1.60	none
105	1.60	0	0.00	0.1236	0.07	0.07	1.67	none
106	1.67	0	0.00	0.1661	0.10	0.10	1.77	none
107	1.77	0	0.00	0.1504	0.09	0.09	1.86	none
108	1.86	0	0.00	0.1539	0.09	0.09	1.96	none
109	1.96	0	0.00	0.1697	0.10	0.10	2.06	none
110	2.06	0	0.00	0.1925	0.12	0.12	2.17	none
111	2.17	0	0.00	0.2051	0.12	0.12	2.30	none
112	2.30	0	0.00	0.2067	0.12	0.12	2.42	none
113	2.42	0	0.00	0.1657	0.10	0.10	2.52	none
114	2.52	0.08	0.08	0.1618	0.10	0.02	2.54	none
115	2.54	0.22	0.22	0.1110	0.07	-0.15	2.38	none
116	2.38	0	0.00	0.1516	0.09	0.09	2.47	none
117	2.47	0	0.00	0.1604	0.09	0.09	2.56	none
118	2.56	0	0.00	0.1650	0.10	0.10	2.66	none
119	2.66	0	0.00	0.1768	0.11	0.11	2.77	none
120	2.77	0	0.00	0.1677	0.10	0.10	2.87	none
121	2.87	0.24	0.24	0.1476	0.09	-0.15	2.72	none
122	2.72	0	0.00	0.1409	0.08	0.08	2.80	none
123	2.80	0.27	0.27	0.1102	0.07	-0.20	2.60	none
124	2.60	0	0.00	0.1571	0.09	0.09	2.69	none
125	2.69	0	0.00	0.1780	0.11	0.11	2.80	none
126	2.80	0	0.00	0.1831	0.11	0.11	2.91	none
127	2.91	0.31	0.31	0.1750	0.11	-0.20	2.71	none
128	2.71	0.19	0.19	0.1390	0.08	-0.11	2.60	none
129	2.60	0.08	0.08	0.1551	0.09	0.01	2.61	none
130	2.61	0.01	0.01	0.1559	0.09	0.08	2.70	none
131	2.70	0	0.00	0.1311	0.08	0.08	2.78	none
132	2.78	0	0.00	0.1555	0.09	0.09	2.87	none
133	2.87	0.06	0.06	0.0976	0.06	0.00	2.87	none
134	2.87	0	0.00	0.1303	0.08	0.08	2.95	none
135	2.95	0.1	0.10	0.1453	0.09	-0.01	2.93	none
136	2.93	0.4	0.40	0.1343	0.08	-0.32	2.61	none
137	2.61	0.01	0.01	0.1382	0.08	0.07	2.69	none
138	2.69	0.02	0.02	0.1720	0.10	0.08	2.77	none
139	2.77	0	0.00	0.1335	0.08	0.08	2.85	none
140	2.85	0	0.00	0.1638	0.10	0.10	2.95	none
141	2.95	0	0.00	0.1953	0.12	0.12	3.06	none
142	3.06	0	0.00	0.2114	0.13	0.13	3.19	none
143	3.19	0	0.00	0.2236	0.13	0.13	3.33	none
144	3.33	0.21	0.21	0.2303	0.14	-0.07	3.25	none
145	3.25	0	0.00	0.1720	0.10	0.10	3.36	none
146	3.36	0	0.00	0.1256	0.08	0.08	3.43	none
147	3.43	0	0.00	0.1193	0.07	0.07	3.50	none
148	3.50	0	0.00	0.1713	0.10	0.10	3.61	none
149	3.61	0	0.00	0.1866	0.11	0.11	3.72	none
150	3.72	0	0.00	0.1941	0.12	0.12	3.84	none
151	3.84	0	0.00	0.1806	0.11	0.11	3.95	none
152	3.95	0	0.00	0.1980	0.12	0.12	4.07	none
153	4.07	0	0.00	0.1795	0.11	0.11	4.17	none
154	4.17	0	0.00	0.1858	0.11	0.11	4.29	none
155	4.29	0	0.00	0.2055	0.12	0.12	4.37	none
156	4.37	0	0.00	0.2145	0.13	0.13	4.37	none
157	4.37	0	0.00	0.2250	0.14	0.14	4.37	none
158	4.37	0	0.00	0.2250	0.14	0.14	4.37	none
159	4.37	0	0.00	0.2138	0.13	0.13	4.37	none
160	4.37	0	0.00	0.2193	0.13	0.13	4.37	none
161	4.37	0	0.00	0.2433	0.15	0.15	4.37	none
162	4.37	0	0.00	0.2508	0.15	0.15	4.37	none
163	4.37	0	0.00	0.2622	0.16	0.16	4.37	none
164	4.37	0	0.00	0.2740	0.16	0.16	4.37	none
165	4.37	0	0.00	0.2488	0.15	0.15	4.37	none
166	4.37	0	0.00	0.2543	0.15	0.15	4.37	none
167	4.37	0	0.00	0.2189	0.13	0.13	4.37	none
168	4.37	0	0.00	0.2193	0.13	0.13	4.37	none
169	4.37	0	0.00	0.2461	0.15	0.15	4.37	none
170	4.37	0	0.00	0.2526	0.15	0.15	4.37	none
171	4.37	0	0.00	0.2634	0.16	0.16	4.37	none
172	4.37	0	0.00	0.2358	0.14	0.14	4.37	none
173	4.37	0	0.00	0.2736	0.16	0.16	4.37	none
174	4.37	0	0.00	0.2535	0.15	0.15	4.37	none
175	4.37	0	0.00	0.2732	0.16	0.16	4.37	none
176	4.37	0	0.00	0.2626	0.16	0.16	4.37	none
177	4.37	0	0.00	0.2693	0.16	0.16	4.37	none
178	4.37	0	0.00	0.2769	0.17	0.17	4.37	none
179	4.37	0	0.00	0.2870	0.17	0.17	4.37	none
180	4.37	0	0.00	0.2508	0.15	0.15	4.37	none
181	4.37	0	0.00	0.2768	0.17	0.17	4.37	none
182	4.37	0.02	0.02	0.2677	0.16	0.14	4.37	none
183	4.37	0.08	0.08	0.2634	0.16	0.08	4.37	none
184	4.37	0.09	0.08	0.2087	0.13	0.05	4.37	none
185	4.37	0	0.00	0.2173	0.13	0.13	4.37	none
186	4.37	0	0.00	0.2409	0.14	0.14	4.37	none

187	4.37	0	0.00	0.2542	0.16	0.16	4.37	none
188	4.37	0	0.00	0.2803	0.17	0.17	4.37	none
189	4.37	0	0.00	0.2630	0.16	0.16	4.37	none
190	4.37	0.02	0.02	0.2063	0.12	0.10	4.37	none
191	4.37	0.19	0.19	0.2268	0.14	-0.05	4.31	none
192	4.31	0	0.00	0.2461	0.15	0.15	4.37	none
193	4.37	0.01	0.01	0.2374	0.14	0.13	4.37	none
194	4.37	0	0.00	0.2546	0.16	0.16	4.37	none
195	4.37	0	0.00	0.2496	0.15	0.15	4.37	none
196	4.37	0.05	0.05	0.2469	0.15	0.10	4.37	none
197	4.37	0	0.00	0.2453	0.15	0.15	4.37	none
198	4.37	0	0.00	0.2634	0.16	0.16	4.37	none
199	4.37	0	0.00	0.2539	0.15	0.15	4.37	none
200	4.37	0	0.00	0.2776	0.17	0.17	4.37	none
201	4.37	0	0.00	0.2921	0.18	0.18	4.37	none
202	4.37	0	0.00	0.2587	0.16	0.16	4.37	none
203	4.37	0	0.00	0.2654	0.16	0.16	4.37	none
204	4.37	0	0.00	0.2575	0.15	0.15	4.37	none
205	4.37	0	0.00	0.2591	0.16	0.16	4.37	none
206	4.37	0.03	0.03	0.2461	0.15	0.12	4.37	none
207	4.37	0	0.00	0.2756	0.17	0.17	4.37	none
208	4.37	0	0.00	0.2591	0.16	0.16	4.37	none
209	4.37	0	0.00	0.2669	0.16	0.16	4.37	none
210	4.37	0	0.00	0.2642	0.16	0.16	4.37	none
211	4.37	0	0.00	0.2685	0.16	0.16	4.37	none
212	4.37	0.09	0.09	0.2142	0.13	0.04	4.37	none
213	4.37	0	0.00	0.2402	0.14	0.14	4.37	none
214	4.37	0	0.00	0.2339	0.14	0.14	4.37	none
215	4.37	0.22	0.22	0.2673	0.16	-0.06	4.31	none
216	4.31	0	0.00	0.2409	0.14	0.14	4.37	none
217	4.37	0	0.00	0.2539	0.15	0.15	4.37	none
218	4.37	0	0.00	0.2374	0.14	0.14	4.37	none
219	4.37	0	0.00	0.2524	0.15	0.15	4.37	none
220	4.37	0	0.00	0.2492	0.15	0.15	4.37	none
221	4.37	0	0.00	0.2610	0.16	0.16	4.37	none
222	4.37	0	0.00	0.2531	0.15	0.15	4.37	none
223	4.37	0	0.00	0.2354	0.14	0.14	4.37	none
224	4.37	0	0.00	0.2417	0.15	0.15	4.37	none
225	4.37	0	0.00	0.2461	0.15	0.15	4.37	none
226	4.37	0	0.00	0.2520	0.15	0.15	4.37	none
227	4.37	0	0.00	0.2205	0.13	0.13	4.37	none
228	4.37	0.18	0.18	0.2205	0.13	-0.05	4.32	none
229	4.32	0	0.00	0.2114	0.13	0.13	4.37	none
230	4.37	0	0.00	0.2020	0.12	0.12	4.37	none
231	4.37	0	0.00	0.2106	0.13	0.13	4.37	none
232	4.37	0	0.00	0.2028	0.12	0.12	4.37	none
233	4.37	0	0.00	0.1791	0.11	0.11	4.37	none
234	4.37	0	0.00	0.2067	0.12	0.12	4.37	none
235	4.37	0	0.00	0.2110	0.13	0.13	4.37	none
236	4.37	0	0.00	0.2094	0.13	0.13	4.37	none
237	4.37	0.29	0.29	0.1941	0.12	-0.17	4.19	none
238	4.19	0.01	0.01	0.1445	0.09	0.08	4.27	none
239	4.27	0.08	0.08	0.1815	0.11	0.03	4.30	none
240	4.30	0	0.00	0.1776	0.11	0.11	4.37	none
241	4.37	0	0.00	0.2043	0.12	0.12	4.37	none
242	4.37	0	0.00	0.2094	0.13	0.13	4.37	none
243	4.37	0	0.00	0.1815	0.11	0.11	4.37	none
244	4.37	0	0.00	0.1791	0.11	0.11	4.37	none
245	4.37	0	0.00	0.1559	0.09	0.09	4.37	none
246	4.37	0	0.00	0.1854	0.11	0.11	4.37	none
247	4.37	0	0.00	0.2004	0.12	0.12	4.37	none
248	4.37	0	0.00	0.1961	0.12	0.12	4.37	none
249	4.37	0	0.00	0.2035	0.12	0.12	4.37	none
250	4.37	0	0.00	0.1961	0.12	0.12	4.37	none
251	4.37	0.41	0.41	0.1079	0.06	-0.35	4.02	none
252	4.02	0.33	0.33	0.1185	0.07	-0.26	3.76	none
253	3.76	0.26	0.26	0.1197	0.07	-0.19	3.58	none
254	3.58	1.19	1.19	0.0921	0.06	-1.13	2.44	none
255	2.44	0.18	0.18	0.1035	0.06	-0.12	2.32	none
256	2.32	0	0.00	0.1335	0.08	0.08	2.40	none
257	2.40	0.02	0.02	0.1393	0.08	0.06	2.47	none
258	2.47	0	0.00	0.1394	0.08	0.08	2.55	none
259	2.55	0	0.00	0.1555	0.09	0.09	2.64	none
260	2.64	0	0.00	0.1657	0.10	0.10	2.74	none
261	2.74	0	0.00	0.1547	0.09	0.09	2.84	none
262	2.84	0	0.00	0.1642	0.10	0.10	2.93	none
263	2.93	0	0.00	0.1654	0.10	0.10	3.03	none
264	3.03	0	0.00	0.1701	0.10	0.10	3.14	none
265	3.14	0	0.00	0.1390	0.08	0.08	3.22	none
266	3.22	0	0.00	0.1319	0.08	0.08	3.30	none
267	3.30	0	0.00	0.1236	0.07	0.07	3.37	none
268	3.37	0	0.00	0.1465	0.09	0.09	3.46	none
269	3.46	0	0.00	0.1480	0.09	0.09	3.55	none
270	3.55	0	0.00	0.1311	0.08	0.08	3.63	none
271	3.63	0	0.00	0.1433	0.09	0.09	3.71	none
272	3.71	0	0.00	0.1524	0.09	0.09	3.81	none
273	3.81	0	0.00	0.1535	0.09	0.09	3.90	none
274	3.90	0	0.00	0.1496	0.09	0.09	3.99	none
275	3.99	0	0.00	0.1618	0.10	0.10	4.08	none
276	4.08	0	0.00	0.1591	0.10	0.10	4.18	none
277	4.18	0	0.00	0.1421	0.09	0.09	4.27	none
278	4.27	0	0.00	0.1437	0.09	0.09	4.35	none
279	4.35	0	0.00	0.1472	0.09	0.09	4.37	none
280	4.37	0	0.00	0.1319	0.08	0.08	4.37	none
281	4.37	0	0.00	0.1282	0.08	0.08	4.37	none
282	4.37	0	0.00	0.1461	0.09	0.09	4.37	none
283	4.37	0	0.00	0.1516	0.09	0.09	4.37	none
284	4.37	0	0.00	0.1382	0.08	0.08	4.37	none
285	4.37	0	0.00	0.1291	0.08	0.08	4.37	none
286	4.37	0	0.00	0.1260	0.08	0.08	4.37	none
287	4.37	0.23	0.23	0.0701	0.04	-0.19	4.18	none
288	4.18	0.08	0.08	0.0972	0.06	-0.02	4.16	none

	289	4.16	0.33	0.33	0.0917	0.06	-0.27	3.88	none
	290	3.88	0.03	0.03	0.0480	0.03	0.00	3.88	none
	291	3.88	0	0.00	0.0579	0.03	0.03	3.92	none
	292	3.92	0	0.00	0.0626	0.04	0.04	3.95	none
	293	3.95	0	0.00	0.0728	0.04	0.04	4.00	none
	294	4.00	0	0.00	0.0776	0.05	0.05	4.04	none
	295	4.04	0	0.00	0.0823	0.05	0.05	4.09	none
	296	4.09	0	0.00	0.0835	0.05	0.05	4.14	none
	297	4.14	0	0.00	0.0819	0.05	0.05	4.19	none
	298	4.19	0	0.00	0.0594	0.04	0.04	4.23	none
	299	4.23	0	0.00	0.0551	0.04	0.04	4.27	none
	300	4.27	0	0.00	0.0673	0.04	0.04	4.31	none
	301	4.31	0.12	0.12	0.0406	0.02	-0.10	4.21	none
	302	4.21	0	0.00	0.0524	0.03	0.03	4.24	none
	303	4.24	0	0.00	0.0563	0.03	0.03	4.28	none
	304	4.28	0	0.00	0.0630	0.04	0.04	4.32	none
	305	4.32	0	0.00	0.0697	0.04	0.04	4.36	none
	306	4.36	0	0.00	0.0685	0.04	0.04	4.37	none
	307	4.37	0	0.00	0.0713	0.04	0.04	4.37	none
	308	4.37	0	0.00	0.0736	0.04	0.04	4.37	none
	309	4.37	0	0.00	0.0710	0.04	0.04	4.37	none
	310	4.37	0	0.00	0.0858	0.05	0.05	4.37	none
	311	4.37	0	0.00	0.0803	0.05	0.05	4.37	none
	312	4.37	0	0.00	0.0799	0.05	0.05	4.37	none
	313	4.37	0	0.00	0.0815	0.05	0.05	4.37	none
	314	4.37	0	0.00	0.0791	0.05	0.05	4.37	none
	315	4.37	0	0.00	0.0720	0.04	0.04	4.37	none
	316	4.37	0	0.00	0.0713	0.04	0.04	4.37	none
	317	4.37	0	0.00	0.0551	0.03	0.03	4.37	none
	318	4.37	0.06	0.06	0.0551	0.03	-0.03	4.34	none
	319	4.34	0	0.00	0.0425	0.03	0.03	4.37	none
	320	4.37	0	0.00	0.0350	0.02	0.02	4.37	none
	321	4.37	0	0.00	0.0350	0.02	0.02	4.37	none
	322	4.37	0	0.00	0.0311	0.02	0.02	4.37	none
	323	4.37	0	0.00	0.0370	0.02	0.02	4.37	none
	324	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
	325	4.37	0	0.00	0.0433	0.03	0.03	4.37	none
	326	4.37	0	0.00	0.0484	0.03	0.03	4.37	none
	327	4.37	0	0.00	0.0413	0.02	0.02	4.37	none
	328	4.37	0	0.00	0.0421	0.03	0.03	4.37	none
	329	4.37	0.24	0.24	0.0370	0.02	-0.22	4.15	none
	330	4.15	0	0.00	0.0378	0.02	0.02	4.17	none
	331	4.17	0	0.00	0.0303	0.02	0.02	4.19	none
	332	4.19	0	0.00	0.0374	0.02	0.02	4.21	none
	333	4.21	0	0.00	0.0358	0.02	0.02	4.24	none
	334	4.24	0	0.00	0.0394	0.02	0.02	4.26	none
	335	4.26	0	0.00	0.0272	0.02	0.02	4.27	none
	336	4.27	0	0.00	0.0386	0.02	0.02	4.30	none
	337	4.30	0	0.00	0.0413	0.02	0.02	4.32	none
	338	4.32	0	0.00	0.0382	0.02	0.02	4.35	none
	339	4.35	0	0.00	0.0425	0.03	0.03	4.37	none
	340	4.37	0.02	0.02	0.0370	0.02	0.00	4.37	none
	341	4.37	0	0.00	0.0445	0.03	0.03	4.37	none
	342	4.37	0	0.00	0.0354	0.02	0.02	4.37	none
	343	4.37	0	0.00	0.0307	0.02	0.02	4.37	none
	344	4.37	0	0.00	0.0295	0.02	0.02	4.37	none
	345	4.37	0	0.00	0.0315	0.02	0.02	4.37	none
	346	4.37	0	0.00	0.0327	0.02	0.02	4.37	none
	347	4.37	0	0.00	0.0374	0.02	0.02	4.37	none
	348	4.37	0	0.00	0.0409	0.02	0.02	4.37	none
	349	4.37	0	0.00	0.0457	0.03	0.03	4.37	none
	350	4.37	0	0.00	0.0386	0.02	0.02	4.37	none
	351	4.37	0	0.00	0.0524	0.03	0.03	4.37	none
	352	4.37	0	0.00	0.0496	0.03	0.03	4.37	none
	353	4.37	0	0.00	0.0445	0.03	0.03	4.37	none
	354	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
	355	4.37	0	0.00	0.0445	0.03	0.03	4.37	none
	356	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
	357	4.37	0	0.00	0.0402	0.02	0.02	4.37	none
	358	4.37	0	0.00	0.0402	0.02	0.02	4.37	none
	359	4.37	0	0.00	0.0433	0.03	0.03	4.37	none
	360	4.37	0	0.00	0.0358	0.02	0.02	4.37	none
	361	4.37	0	0.00	0.0433	0.03	0.03	4.37	none
	362	4.37	0	0.00	0.0488	0.03	0.03	4.37	none
	363	4.37	0	0.00	0.0425	0.03	0.03	4.37	none
	364	4.37	0	0.00	0.0508	0.03	0.03	4.37	none
	365	4.37	0	0.00	0.0492	0.03	0.03	4.37	none
	366	4.37	0	0.00	0.0453	0.03	0.03	4.37	none
1980	1	4.37	0	0.00	0.0130	0.01	0.01	4.37	none
	2	4.37	0	0.00	0.0165	0.01	0.01	4.37	none
	3	4.37	0	0.00	0.0173	0.01	0.01	4.37	none
	4	4.37	0	0.00	0.0102	0.01	0.01	4.37	none
	5	4.37	0	0.00	0.0102	0.01	0.01	4.37	none
	6	4.37	0	0.00	0.0106	0.01	0.01	4.37	none
	7	4.37	0	0.00	0.0248	0.01	0.01	4.37	none
	8	4.37	0	0.00	0.0319	0.02	0.02	4.37	none
	9	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
	10	4.37	0.27	0.27	0.0331	0.02	-0.25	4.12	none
	11	4.12	0.06	0.06	0.0343	0.02	-0.04	4.08	none
	12	4.08	0.18	0.18	0.0130	0.01	-0.17	3.91	none
	13	3.91	0.13	0.13	0.0193	0.01	-0.12	3.79	none
	14	3.79	0.02	0.02	0.0244	0.01	-0.01	3.78	none
	15	3.78	0	0.00	0.0370	0.02	0.02	3.80	none
	16	3.80	0	0.00	0.0390	0.02	0.02	3.83	none
	17	3.83	0	0.00	0.0197	0.01	0.01	3.84	none
	18	3.84	0.69	0.69	0.0232	0.01	-0.68	3.16	none
	19	3.16	0.39	0.39	0.0327	0.02	-0.37	2.79	none
	20	2.79	0	0.00	0.0307	0.02	0.02	2.81	none
	21	2.81	0	0.00	0.0323	0.02	0.02	2.83	none
	22	2.83	0	0.00	0.0339	0.02	0.02	2.85	none
	23	2.85	0	0.00	0.0303	0.02	0.02	2.87	none
	24	2.87	0	0.00	0.0287	0.02	0.02	2.89	none

25	2.89	0	0.00	0.0358	0.02	0.02	2.91	none
26	2.91	0	0.00	0.0402	0.02	0.02	2.93	none
27	2.93	0	0.00	0.0409	0.02	0.02	2.96	none
28	2.96	0	0.00	0.0406	0.02	0.02	2.98	none
29	2.98	0.51	0.51	0.0256	0.02	-0.49	2.49	none
30	2.49	0.19	0.19	0.0425	0.03	-0.16	2.32	none
31	2.32	0	0.00	0.0291	0.02	0.02	2.34	none
32	2.34	0	0.00	0.0343	0.02	0.02	2.36	none
33	2.36	0	0.00	0.0358	0.02	0.02	2.38	none
34	2.38	0	0.00	0.0378	0.02	0.02	2.40	none
35	2.40	0	0.00	0.0382	0.02	0.02	2.43	none
36	2.43	0	0.00	0.0496	0.03	0.03	2.46	none
37	2.46	0	0.00	0.0406	0.02	0.02	2.48	none
38	2.48	0	0.00	0.0421	0.03	0.03	2.51	none
39	2.51	0	0.00	0.0327	0.02	0.02	2.53	none
40	2.53	0	0.00	0.0335	0.02	0.02	2.55	none
41	2.55	0	0.00	0.0339	0.02	0.02	2.57	none
42	2.57	0	0.00	0.0315	0.02	0.02	2.59	none
43	2.59	0	0.00	0.0386	0.02	0.02	2.61	none
44	2.61	0	0.00	0.0390	0.02	0.02	2.63	none
45	2.63	0.08	0.08	0.0441	0.03	-0.05	2.58	none
46	2.58	0.36	0.36	0.0272	0.02	-0.34	2.23	none
47	2.23	0.02	0.02	0.0449	0.03	0.01	2.24	none
48	2.24	0.14	0.14	0.0539	0.03	-0.11	2.13	none
49	2.13	0.1	0.10	0.0429	0.03	-0.07	2.06	none
50	2.06	0.43	0.43	0.0397	0.04	-0.39	1.67	none
51	1.67	0.36	0.36	0.0286	0.02	-0.34	1.33	none
52	1.33	0.05	0.05	0.0543	0.03	-0.02	1.32	none
53	1.32	0.24	0.24	0.0290	0.02	-0.22	1.09	none
54	1.09	0.02	0.02	0.0510	0.04	0.02	1.11	none
55	1.11	0	0.00	0.0516	0.03	0.03	1.14	none
56	1.14	0	0.00	0.0539	0.03	0.03	1.17	none
57	1.17	0	0.00	0.0587	0.04	0.04	1.21	none
58	1.21	0	0.00	0.0701	0.04	0.04	1.25	none
59	1.25	0	0.00	0.0752	0.05	0.05	1.30	none
60	1.30	0	0.00	0.0732	0.04	0.04	1.34	none
61	1.34	0	0.00	0.0654	0.04	0.04	1.38	none
62	1.38	0	0.00	0.0665	0.04	0.04	1.42	none
63	1.42	0	0.00	0.0681	0.04	0.04	1.46	none
64	1.46	0	0.00	0.0697	0.04	0.04	1.50	none
65	1.50	0	0.00	0.0713	0.04	0.04	1.55	none
66	1.55	0.02	0.02	0.0646	0.04	0.02	1.57	none
67	1.57	0.93	0.93	0.0520	0.03	-0.90	0.67	none
68	0.67	0	0.00	0.0921	0.06	0.06	0.72	none
69	0.72	0	0.00	0.0669	0.04	0.04	0.76	none
70	0.76	0	0.00	0.0634	0.04	0.04	0.80	none
71	0.80	0.08	0.08	0.0738	0.04	-0.04	0.76	none
72	0.76	0	0.00	0.0689	0.04	0.04	0.80	none
73	0.80	0	0.00	0.0512	0.03	0.03	0.84	none
74	0.84	0	0.00	0.0799	0.05	0.05	0.88	none
75	0.88	0	0.00	0.0929	0.06	0.06	0.94	none
76	0.94	0	0.00	0.1020	0.06	0.06	1.00	none
77	1.00	0	0.00	0.0457	0.03	0.03	1.03	none
78	1.03	0	0.00	0.0657	0.04	0.04	1.07	none
79	1.07	0	0.00	0.0803	0.05	0.05	1.12	none
80	1.12	0	0.00	0.0894	0.05	0.05	1.17	none
81	1.17	0	0.00	0.0972	0.06	0.06	1.23	none
82	1.23	0	0.00	0.0382	0.05	0.05	1.28	none
83	1.28	0.15	0.15	0.0585	0.03	-0.12	1.17	none
84	1.17	0	0.00	0.0846	0.05	0.05	1.22	none
85	1.22	0.02	0.02	0.0732	0.04	0.02	1.24	none
86	1.24	0	0.00	0.0657	0.04	0.04	1.28	none
87	1.28	0	0.00	0.0717	0.04	0.04	1.32	none
88	1.32	0	0.00	0.0780	0.05	0.05	1.37	none
89	1.37	0	0.00	0.0772	0.05	0.05	1.42	none
90	1.42	0	0.00	0.0874	0.05	0.05	1.47	none
91	1.47	0	0.00	0.0654	0.04	0.04	1.51	none
92	1.51	0.03	0.03	0.0492	0.03	0.00	1.51	none
93	1.51	0	0.00	0.0736	0.04	0.04	1.55	none
94	1.55	0	0.00	0.0783	0.05	0.05	1.60	none
95	1.60	0	0.00	0.0839	0.05	0.05	1.65	none
96	1.65	0	0.00	0.1138	0.07	0.07	1.72	none
97	1.72	0	0.00	0.1287	0.08	0.08	1.79	none
98	1.79	0	0.00	0.1161	0.07	0.07	1.86	none
99	1.86	0	0.00	0.0732	0.04	0.04	1.91	none
100	1.91	0	0.00	0.1079	0.06	0.06	1.97	none
101	1.97	0	0.00	0.1413	0.08	0.08	2.06	none
102	2.06	0	0.00	0.1122	0.07	0.07	2.12	none
103	2.12	0	0.00	0.0909	0.05	0.05	2.18	none
104	2.18	0	0.00	0.1008	0.06	0.06	2.24	none
105	2.24	0	0.00	0.1236	0.07	0.07	2.31	none
106	2.31	0	0.00	0.1651	0.10	0.10	2.41	none
107	2.41	0	0.00	0.1504	0.09	0.09	2.50	none
108	2.50	0	0.00	0.1539	0.09	0.09	2.60	none
109	2.60	0	0.00	0.1687	0.10	0.10	2.70	none
110	2.70	0	0.00	0.1925	0.12	0.12	2.81	none
111	2.81	0	0.00	0.2051	0.12	0.12	2.94	none
112	2.94	0	0.00	0.2057	0.12	0.12	3.06	none
113	3.06	0	0.00	0.1657	0.10	0.10	3.16	none
114	3.16	0.08	0.08	0.1610	0.10	0.02	3.18	none
115	3.18	0.22	0.22	0.1110	0.07	-0.15	3.02	none
116	3.02	0	0.00	0.1518	0.09	0.09	3.11	none
117	3.11	0	0.00	0.1504	0.09	0.09	3.20	none
118	3.20	0	0.00	0.1650	0.10	0.10	3.30	none
119	3.30	0	0.00	0.1768	0.11	0.11	3.41	none
120	3.41	0	0.00	0.1677	0.10	0.10	3.51	none
121	3.51	0.24	0.24	0.1476	0.09	-0.15	3.36	none
122	3.36	0	0.00	0.1409	0.08	0.08	3.44	none
123	3.44	0.27	0.27	0.1102	0.07	-0.20	3.24	none
124	3.24	0	0.00	0.1571	0.09	0.09	3.33	none
125	3.33	0	0.00	0.1780	0.11	0.11	3.44	none
126	3.44	0	0.00	0.1831	0.11	0.11	3.55	none

127	3.55	0.31	0.31	0.1760	0.11	-0.20	3.35	none
128	3.35	0.19	0.19	0.1390	0.08	-0.11	3.24	none
129	3.24	0.08	0.08	0.1551	0.09	0.01	3.25	none
130	3.25	0.01	0.01	0.1559	0.09	0.08	3.34	none
131	3.34	0	0.00	0.1311	0.08	0.08	3.41	none
132	3.41	0	0.00	0.1555	0.09	0.09	3.51	none
133	3.51	0.06	0.06	0.0976	0.06	0.00	3.51	none
134	3.51	0	0.00	0.1303	0.08	0.08	3.58	none
135	3.58	0.1	0.10	0.1453	0.09	-0.01	3.57	none
136	3.57	0.4	0.40	0.1343	0.08	-0.32	3.25	none
137	3.25	0.01	0.01	0.1382	0.08	0.07	3.32	none
138	3.32	0.02	0.02	0.1720	0.10	0.08	3.41	none
139	3.41	0	0.00	0.1335	0.08	0.08	3.49	none
140	3.49	0	0.00	0.1638	0.10	0.10	3.59	none
141	3.59	0	0.00	0.1953	0.12	0.12	3.70	none
142	3.70	0	0.00	0.2114	0.13	0.13	3.83	none
143	3.83	0	0.00	0.2236	0.13	0.13	3.96	none
144	3.96	0.21	0.21	0.2303	0.14	-0.07	3.89	none
145	3.89	0	0.00	0.1720	0.10	0.10	4.00	none
146	4.00	0	0.00	0.1256	0.08	0.08	4.07	none
147	4.07	0	0.00	0.1193	0.07	0.07	4.14	none
148	4.14	0	0.00	0.1713	0.10	0.10	4.25	none
149	4.25	0	0.00	0.1866	0.11	0.11	4.36	none
150	4.36	0	0.00	0.1941	0.12	0.12	4.37	none
151	4.37	0	0.00	0.1866	0.11	0.11	4.37	none
152	4.37	0	0.00	0.1980	0.12	0.12	4.37	none
153	4.37	0	0.00	0.1795	0.11	0.11	4.37	none
154	4.37	0	0.00	0.1856	0.11	0.11	4.37	none
155	4.37	0	0.00	0.2055	0.12	0.12	4.37	none
156	4.37	0	0.00	0.2146	0.13	0.13	4.37	none
157	4.37	0	0.00	0.2260	0.14	0.14	4.37	none
158	4.37	0	0.00	0.2260	0.14	0.14	4.37	none
159	4.37	0	0.00	0.2138	0.13	0.13	4.37	none
160	4.37	0	0.00	0.2193	0.13	0.13	4.37	none
161	4.37	0	0.00	0.2453	0.15	0.15	4.37	none
162	4.37	0	0.00	0.2508	0.15	0.15	4.37	none
163	4.37	0	0.00	0.2622	0.16	0.16	4.37	none
164	4.37	0	0.00	0.2740	0.16	0.16	4.37	none
165	4.37	0	0.00	0.2488	0.15	0.15	4.37	none
166	4.37	0	0.00	0.2543	0.15	0.15	4.37	none
167	4.37	0	0.00	0.2189	0.13	0.13	4.37	none
168	4.37	0	0.00	0.2193	0.13	0.13	4.37	none
169	4.37	0	0.00	0.2461	0.15	0.15	4.37	none
170	4.37	0	0.00	0.2528	0.15	0.15	4.37	none
171	4.37	0	0.00	0.2634	0.16	0.16	4.37	none
172	4.37	0	0.00	0.2356	0.14	0.14	4.37	none
173	4.37	0	0.00	0.2736	0.16	0.16	4.37	none
174	4.37	0	0.00	0.2535	0.15	0.15	4.37	none
175	4.37	0	0.00	0.2732	0.16	0.16	4.37	none
176	4.37	0	0.00	0.2626	0.16	0.16	4.37	none
177	4.37	0	0.00	0.2693	0.16	0.16	4.37	none
178	4.37	0	0.00	0.2799	0.17	0.17	4.37	none
179	4.37	0	0.00	0.2870	0.17	0.17	4.37	none
180	4.37	0	0.00	0.2508	0.15	0.15	4.37	none
181	4.37	0	0.00	0.2768	0.17	0.17	4.37	none
182	4.37	0.02	0.02	0.2577	0.16	0.14	4.37	none
183	4.37	0.08	0.08	0.2634	0.16	0.08	4.37	none
184	4.37	0.08	0.08	0.2087	0.13	0.05	4.37	none
185	4.37	0	0.00	0.2173	0.13	0.13	4.37	none
186	4.37	0	0.00	0.2409	0.14	0.14	4.37	none
187	4.37	0	0.00	0.2642	0.16	0.16	4.37	none
188	4.37	0	0.00	0.2903	0.17	0.17	4.37	none
189	4.37	0	0.00	0.2630	0.16	0.16	4.37	none
190	4.37	0.02	0.02	0.2063	0.12	0.10	4.37	none
191	4.37	0.19	0.19	0.2268	0.14	-0.05	4.31	none
192	4.31	0	0.00	0.2461	0.15	0.15	4.37	none
193	4.37	0.01	0.01	0.2374	0.14	0.13	4.37	none
194	4.37	0	0.00	0.2646	0.16	0.16	4.37	none
195	4.37	0	0.00	0.2498	0.15	0.15	4.37	none
196	4.37	0.05	0.05	0.2469	0.15	0.10	4.37	none
197	4.37	0	0.00	0.2453	0.15	0.15	4.37	none
198	4.37	0	0.00	0.2634	0.16	0.16	4.37	none
199	4.37	0	0.00	0.2539	0.15	0.15	4.37	none
200	4.37	0	0.00	0.2775	0.17	0.17	4.37	none
201	4.37	0	0.00	0.2921	0.18	0.18	4.37	none
202	4.37	0	0.00	0.2587	0.16	0.16	4.37	none
203	4.37	0	0.00	0.2564	0.16	0.16	4.37	none
204	4.37	0	0.00	0.2575	0.15	0.15	4.37	none
205	4.37	0	0.00	0.2591	0.16	0.16	4.37	none
206	4.37	0.03	0.03	0.2401	0.15	0.12	4.37	none
207	4.37	0	0.00	0.2755	0.17	0.17	4.37	none
208	4.37	0	0.00	0.2591	0.16	0.16	4.37	none
209	4.37	0	0.00	0.2559	0.16	0.16	4.37	none
210	4.37	0	0.00	0.2642	0.16	0.16	4.37	none
211	4.37	0	0.00	0.2685	0.16	0.16	4.37	none
212	4.37	0.09	0.09	0.2142	0.13	0.04	4.37	none
213	4.37	0	0.00	0.2402	0.14	0.14	4.37	none
214	4.37	0	0.00	0.2339	0.14	0.14	4.37	none
215	4.37	0.22	0.22	0.2573	0.16	-0.06	4.31	none
216	4.31	0	0.00	0.2409	0.14	0.14	4.37	none
217	4.37	0	0.00	0.2539	0.15	0.15	4.37	none
218	4.37	0	0.00	0.2374	0.14	0.14	4.37	none
219	4.37	0	0.00	0.2524	0.15	0.15	4.37	none
220	4.37	0	0.00	0.2492	0.15	0.15	4.37	none
221	4.37	0	0.00	0.2510	0.16	0.16	4.37	none
222	4.37	0	0.00	0.2531	0.15	0.15	4.37	none
223	4.37	0	0.00	0.2354	0.14	0.14	4.37	none
224	4.37	0	0.00	0.2417	0.15	0.15	4.37	none
225	4.37	0	0.00	0.2461	0.15	0.15	4.37	none
226	4.37	0	0.00	0.2520	0.15	0.15	4.37	none
227	4.37	0	0.00	0.2205	0.13	0.13	4.37	none
228	4.37	0.18	0.18	0.2205	0.13	-0.05	4.32	none

229	4.32	0	0.00	0.2114	0.13	0.13	4.37	none
230	4.37	0	0.00	0.2020	0.12	0.12	4.37	none
231	4.37	0	0.00	0.2106	0.13	0.13	4.37	none
232	4.37	0	0.00	0.2028	0.12	0.12	4.37	none
233	4.37	0	0.00	0.1791	0.11	0.11	4.37	none
234	4.37	0	0.00	0.2007	0.12	0.12	4.37	none
235	4.37	0	0.00	0.2110	0.13	0.13	4.37	none
236	4.37	0	0.00	0.2094	0.13	0.13	4.37	none
237	4.37	0.29	0.29	0.1941	0.12	-0.17	4.19	none
238	4.19	0.01	0.01	0.1445	0.09	0.08	4.27	none
239	4.27	0.08	0.08	0.1815	0.11	0.03	4.30	none
240	4.30	0	0.00	0.1776	0.11	0.11	4.37	none
241	4.37	0	0.00	0.2043	0.12	0.12	4.37	none
242	4.37	0	0.00	0.2094	0.13	0.13	4.37	none
243	4.37	0	0.00	0.1815	0.11	0.11	4.37	none
244	4.37	0	0.00	0.1791	0.11	0.11	4.37	none
245	4.37	0	0.00	0.1559	0.09	0.09	4.37	none
246	4.37	0	0.00	0.1854	0.11	0.11	4.37	none
247	4.37	0	0.00	0.2004	0.12	0.12	4.37	none
248	4.37	0	0.00	0.1961	0.12	0.12	4.37	none
249	4.37	0	0.00	0.2035	0.12	0.12	4.37	none
250	4.37	0	0.00	0.1961	0.12	0.12	4.37	none
251	4.37	0.41	0.41	0.1079	0.06	-0.35	4.02	none
252	4.02	0.33	0.33	0.1185	0.07	-0.26	3.76	none
253	3.76	0.26	0.26	0.1197	0.07	-0.19	3.58	none
254	3.58	1.19	1.19	0.0921	0.06	-1.13	2.44	none
255	2.44	0.12	0.18	0.1035	0.06	-0.12	2.32	none
256	2.32	0	0.00	0.1335	0.08	0.08	2.40	none
257	2.40	0.02	0.02	0.1398	0.08	0.06	2.47	none
258	2.47	0	0.00	0.1394	0.08	0.08	2.55	none
259	2.55	0	0.00	0.1555	0.09	0.09	2.64	none
260	2.64	0	0.00	0.1657	0.10	0.10	2.74	none
261	2.74	0	0.00	0.1647	0.09	0.09	2.84	none
262	2.84	0	0.00	0.1642	0.10	0.10	2.93	none
263	2.93	0	0.00	0.1654	0.10	0.10	3.03	none
264	3.03	0	0.00	0.1701	0.10	0.10	3.14	none
265	3.14	0	0.00	0.1390	0.08	0.08	3.22	none
266	3.22	0	0.00	0.1519	0.08	0.08	3.30	none
267	3.30	0	0.00	0.1236	0.07	0.07	3.37	none
268	3.37	0	0.00	0.1465	0.09	0.09	3.46	none
269	3.46	0	0.00	0.1480	0.09	0.09	3.55	none
270	3.55	0	0.00	0.1311	0.08	0.08	3.63	none
271	3.63	0	0.00	0.1433	0.09	0.09	3.71	none
272	3.71	0	0.00	0.1524	0.09	0.09	3.81	none
273	3.81	0	0.00	0.1535	0.09	0.09	3.90	none
274	3.90	0	0.00	0.1496	0.09	0.09	3.99	none
275	3.99	0	0.00	0.1618	0.10	0.10	4.08	none
276	4.08	0	0.00	0.1591	0.10	0.10	4.18	none
277	4.18	0	0.00	0.1421	0.09	0.09	4.27	none
278	4.27	0	0.00	0.1437	0.09	0.09	4.35	none
279	4.35	0	0.00	0.1472	0.09	0.09	4.37	none
280	4.37	0	0.00	0.1319	0.08	0.08	4.37	none
281	4.37	0	0.00	0.1392	0.08	0.08	4.37	none
282	4.37	0	0.00	0.1461	0.09	0.09	4.37	none
283	4.37	0	0.00	0.1516	0.09	0.09	4.37	none
284	4.37	0	0.00	0.1362	0.08	0.08	4.37	none
285	4.37	0	0.00	0.1291	0.08	0.08	4.37	none
286	4.37	0	0.00	0.1280	0.08	0.08	4.37	none
287	4.37	0.23	0.23	0.0701	0.04	-0.19	4.18	none
288	4.18	0.08	0.08	0.0972	0.06	-0.02	4.16	none
289	4.16	0.33	0.33	0.0917	0.06	-0.27	3.88	none
290	3.88	0.03	0.03	0.0480	0.03	0.00	3.88	none
291	3.88	0	0.00	0.0579	0.03	0.03	3.92	none
292	3.92	0	0.00	0.0626	0.04	0.04	3.95	none
293	3.95	0	0.00	0.0728	0.04	0.04	4.00	none
294	4.00	0	0.00	0.0776	0.05	0.05	4.04	none
295	4.04	0	0.00	0.0923	0.05	0.05	4.09	none
296	4.09	0	0.00	0.0935	0.05	0.05	4.14	none
297	4.14	0	0.00	0.0819	0.05	0.05	4.19	none
298	4.19	0	0.00	0.0564	0.04	0.04	4.23	none
299	4.23	0	0.00	0.0661	0.04	0.04	4.27	none
300	4.27	0	0.00	0.0673	0.04	0.04	4.31	none
301	4.31	0.12	0.12	0.0405	0.02	-0.10	4.21	none
302	4.21	0	0.00	0.0524	0.03	0.03	4.24	none
303	4.24	0	0.00	0.0583	0.03	0.03	4.28	none
304	4.28	0	0.00	0.0630	0.04	0.04	4.32	none
305	4.32	0	0.00	0.0687	0.04	0.04	4.36	none
306	4.36	0	0.00	0.0665	0.04	0.04	4.37	none
307	4.37	0	0.00	0.0713	0.04	0.04	4.37	none
308	4.37	0	0.00	0.0736	0.04	0.04	4.37	none
309	4.37	0	0.00	0.0710	0.04	0.04	4.37	none
310	4.37	0	0.00	0.0858	0.05	0.05	4.37	none
311	4.37	0	0.00	0.0803	0.05	0.05	4.37	none
312	4.37	0	0.00	0.0799	0.05	0.05	4.37	none
313	4.37	0	0.00	0.0815	0.05	0.05	4.37	none
314	4.37	0	0.00	0.0791	0.05	0.05	4.37	none
315	4.37	0	0.00	0.0720	0.04	0.04	4.37	none
316	4.37	0	0.00	0.0713	0.04	0.04	4.37	none
317	4.37	0	0.00	0.0551	0.03	0.03	4.37	none
318	4.37	0.06	0.06	0.0551	0.03	-0.03	4.34	none
319	4.34	0	0.00	0.0425	0.03	0.03	4.37	none
320	4.37	0	0.00	0.0350	0.02	0.02	4.37	none
321	4.37	0	0.00	0.0350	0.02	0.02	4.37	none
322	4.37	0	0.00	0.0311	0.02	0.02	4.37	none
323	4.37	0	0.00	0.0370	0.02	0.02	4.37	none
324	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
325	4.37	0	0.00	0.0433	0.03	0.03	4.37	none
326	4.37	0	0.00	0.0484	0.03	0.03	4.37	none
327	4.37	0	0.00	0.0413	0.02	0.02	4.37	none
328	4.37	0	0.00	0.0421	0.03	0.03	4.37	none
329	4.37	0.24	0.24	0.0370	0.02	-0.22	4.15	none
330	4.15	0	0.00	0.0378	0.02	0.02	4.17	none

	331	4.17	0	0.00	0.0303	0.02	0.02	4.19	none
	332	4.19	0	0.00	0.0374	0.02	0.02	4.21	none
	333	4.21	0	0.00	0.0258	0.02	0.02	4.24	none
	334	4.24	0	0.00	0.0394	0.02	0.02	4.26	none
	335	4.26	0	0.00	0.0272	0.02	0.02	4.27	none
	336	4.27	0	0.00	0.0386	0.02	0.02	4.30	none
	337	4.30	0	0.00	0.0413	0.02	0.02	4.32	none
	338	4.32	0	0.00	0.0382	0.02	0.02	4.35	none
	339	4.35	0	0.00	0.0425	0.03	0.03	4.37	none
	340	4.37	0.02	0.02	0.0370	0.02	0.00	4.37	none
	341	4.37	0	0.00	0.0445	0.03	0.03	4.37	none
	342	4.37	0	0.00	0.0354	0.02	0.02	4.37	none
	343	4.37	0	0.00	0.0307	0.02	0.02	4.37	none
	344	4.37	0	0.00	0.0295	0.02	0.02	4.37	none
	345	4.37	0	0.00	0.0315	0.02	0.02	4.37	none
	346	4.37	0	0.00	0.0327	0.02	0.02	4.37	none
	347	4.37	0	0.00	0.0274	0.02	0.02	4.37	none
	348	4.37	0	0.00	0.0409	0.02	0.02	4.37	none
	349	4.37	0	0.00	0.0457	0.03	0.03	4.37	none
	350	4.37	0	0.00	0.0366	0.02	0.02	4.37	none
	351	4.37	0	0.00	0.0524	0.03	0.03	4.37	none
	352	4.37	0	0.00	0.0496	0.03	0.03	4.37	none
	353	4.37	0	0.00	0.0445	0.03	0.03	4.37	none
	354	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
	355	4.37	0	0.00	0.0445	0.03	0.03	4.37	none
	356	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
	357	4.37	0	0.00	0.0402	0.02	0.02	4.37	none
	358	4.37	0	0.00	0.0402	0.02	0.02	4.37	none
	359	4.37	0	0.00	0.0433	0.03	0.03	4.37	none
	360	4.37	0	0.00	0.0358	0.02	0.02	4.37	none
	361	4.37	0	0.00	0.0433	0.03	0.03	4.37	none
	362	4.37	0	0.00	0.0488	0.03	0.03	4.37	none
	363	4.37	0	0.00	0.0425	0.03	0.03	4.37	none
	364	4.37	0	0.00	0.0508	0.03	0.03	4.37	none
	365	4.37	0	0.00	0.0492	0.03	0.03	4.37	none
	366	4.37	0	0.00	0.0453	0.03	0.03	4.37	none
1980	1	4.37	0	0.00	0.0130	0.01	0.01	4.37	none
	2	4.37	0	0.00	0.0165	0.01	0.01	4.37	none
	3	4.37	0	0.00	0.0173	0.01	0.01	4.37	none
	4	4.37	0	0.00	0.0102	0.01	0.01	4.37	none
	5	4.37	0	0.00	0.0102	0.01	0.01	4.37	none
	6	4.37	0	0.00	0.0106	0.01	0.01	4.37	none
	7	4.37	0	0.00	0.0248	0.01	0.01	4.37	none
	8	4.37	0	0.00	0.0319	0.02	0.02	4.37	none
	9	4.37	0	0.00	0.0406	0.02	0.02	4.37	none
	10	4.37	0.27	0.27	0.0331	0.02	-0.25	4.12	none
	11	4.12	0.06	0.06	0.0343	0.02	-0.04	4.08	none
	12	4.08	0.18	0.18	0.0130	0.01	-0.17	3.91	none
	13	3.91	0.13	0.13	0.0193	0.01	-0.12	3.79	none
	14	3.79	0.02	0.02	0.0244	0.01	-0.01	3.78	none
	15	3.78	0	0.00	0.0170	0.02	0.02	3.80	none
	16	3.80	0	0.00	0.0390	0.02	0.02	3.83	none
	17	3.83	0	0.00	0.0197	0.01	0.01	3.84	none
	18	3.84	0.69	0.69	0.0232	0.01	-0.68	3.16	none
	19	3.16	0.39	0.39	0.0327	0.02	-0.37	2.79	none
	20	2.79	0	0.00	0.0307	0.02	0.02	2.81	none
	21	2.81	0	0.00	0.0323	0.02	0.02	2.83	none
	22	2.83	0	0.00	0.0339	0.02	0.02	2.85	none
	23	2.85	0	0.00	0.0303	0.02	0.02	2.87	none
	24	2.87	0	0.00	0.0287	0.02	0.02	2.89	none
	25	2.89	0	0.00	0.0358	0.02	0.02	2.91	none
	26	2.91	0	0.00	0.0402	0.02	0.02	2.93	none
	27	2.93	0	0.00	0.0409	0.02	0.02	2.96	none
	28	2.96	0	0.00	0.0406	0.02	0.02	2.98	none
	29	2.98	0.51	0.51	0.0256	0.02	-0.49	2.49	none
	30	2.49	0.19	0.19	0.0425	0.03	-0.16	2.32	none
	31	2.32	0	0.00	0.0291	0.02	0.02	2.34	none
	32	2.34	0	0.00	0.0343	0.02	0.02	2.36	none
	33	2.36	0	0.00	0.0358	0.02	0.02	2.38	none
	34	2.38	0	0.00	0.0378	0.02	0.02	2.40	none
	35	2.40	0	0.00	0.0382	0.02	0.02	2.43	none
	36	2.43	0	0.00	0.0496	0.03	0.03	2.46	none
	37	2.46	0	0.00	0.0406	0.02	0.02	2.48	none
	38	2.48	0	0.00	0.0421	0.03	0.03	2.51	none
	39	2.51	0	0.00	0.0327	0.02	0.02	2.53	none
	40	2.53	0	0.00	0.0335	0.02	0.02	2.55	none
	41	2.55	0	0.00	0.0339	0.02	0.02	2.57	none
	42	2.57	0	0.00	0.0315	0.02	0.02	2.59	none
	43	2.59	0	0.00	0.0286	0.02	0.02	2.61	none
	44	2.61	0	0.00	0.0390	0.02	0.02	2.63	none
	45	2.63	0.08	0.08	0.0441	0.03	-0.05	2.58	none
	46	2.58	0.36	0.36	0.0272	0.02	-0.34	2.23	none
	47	2.23	0.02	0.02	0.0449	0.03	0.01	2.24	none
	48	2.24	0.14	0.14	0.0539	0.03	-0.11	2.13	none
	49	2.13	0.1	0.10	0.0429	0.03	-0.07	2.06	none
	50	2.06	0.43	0.43	0.0397	0.04	-0.39	1.67	none
	51	1.67	0.36	0.36	0.0356	0.02	-0.34	1.33	none
	52	1.33	0.05	0.05	0.0543	0.03	-0.02	1.32	none
	53	1.32	0.24	0.24	0.0280	0.02	-0.22	1.09	none
	54	1.09	0.02	0.02	0.0510	0.04	0.02	1.11	none
	55	1.11	0	0.00	0.0516	0.03	0.03	1.14	none
	56	1.14	0	0.00	0.0539	0.03	0.03	1.17	none
	57	1.17	0	0.00	0.0537	0.04	0.04	1.21	none
	58	1.21	0	0.00	0.0701	0.04	0.04	1.25	none
	59	1.25	0	0.00	0.0752	0.05	0.05	1.30	none
	60	1.30	0	0.00	0.0732	0.04	0.04	1.34	none
	61	1.34	0	0.00	0.0754	0.04	0.04	1.38	none
	62	1.38	0	0.00	0.0685	0.04	0.04	1.42	none
	63	1.42	0	0.00	0.0681	0.04	0.04	1.46	none
	64	1.46	0	0.00	0.0697	0.04	0.04	1.50	none
	65	1.50	0	0.00	0.0713	0.04	0.04	1.55	none
	66	1.55	0.02	0.02	0.0645	0.04	0.02	1.57	none

67	1.57	0.93	0.93	0.0520	0.03	-0.90	0.67	none
68	0.67	0	0.00	0.0921	0.06	0.06	0.72	none
69	0.72	0	0.00	0.0669	0.04	0.04	0.76	none
70	0.76	0	0.00	0.0634	0.04	0.04	0.80	none
71	0.80	0.08	0.08	0.0726	0.04	-0.04	0.76	none
72	0.76	0	0.00	0.0689	0.04	0.04	0.80	none
73	0.80	0	0.00	0.0512	0.03	0.03	0.84	none
74	0.84	0	0.00	0.0799	0.05	0.05	0.88	none
75	0.88	0	0.00	0.0929	0.06	0.06	0.94	none
76	0.94	0	0.00	0.1020	0.06	0.06	1.00	none
77	1.00	0	0.00	0.0457	0.03	0.03	1.03	none
78	1.03	0	0.00	0.0557	0.04	0.04	1.07	none
79	1.07	0	0.00	0.0803	0.05	0.05	1.12	none
80	1.12	0	0.00	0.0894	0.05	0.05	1.17	none
81	1.17	0	0.00	0.0972	0.06	0.06	1.23	none
82	1.23	0	0.00	0.0882	0.05	0.05	1.28	none
83	1.28	0.15	0.15	0.0583	0.03	-0.12	1.17	none
84	1.17	0	0.00	0.0846	0.05	0.05	1.22	none
85	1.22	0.02	0.02	0.0732	0.04	0.02	1.24	none
86	1.24	0	0.00	0.0657	0.04	0.04	1.28	none
87	1.28	0	0.00	0.0717	0.04	0.04	1.32	none
88	1.32	0	0.00	0.0780	0.05	0.05	1.37	none
89	1.37	0	0.00	0.0772	0.05	0.05	1.42	none
90	1.42	0	0.00	0.0874	0.05	0.05	1.47	none
91	1.47	0	0.00	0.0654	0.04	0.04	1.51	none
92	1.51	0.03	0.03	0.0492	0.03	0.00	1.51	none
93	1.51	0	0.00	0.0736	0.04	0.04	1.55	none
94	1.55	0	0.00	0.0783	0.05	0.05	1.60	none
95	1.60	0	0.00	0.0839	0.05	0.05	1.65	none
96	1.65	0	0.00	0.1138	0.07	0.07	1.72	none
97	1.72	0	0.00	0.1287	0.08	0.08	1.79	none
98	1.79	0	0.00	0.1161	0.07	0.07	1.86	none
99	1.86	0	0.00	0.0732	0.04	0.04	1.91	none
100	1.91	0	0.00	0.1079	0.06	0.06	1.97	none
101	1.97	0	0.00	0.1413	0.08	0.08	2.06	none
102	2.06	0	0.00	0.1122	0.07	0.07	2.12	none
103	2.12	0	0.00	0.0909	0.05	0.05	2.18	none
104	2.18	0	0.00	0.1009	0.06	0.06	2.24	none
105	2.24	0	0.00	0.1236	0.07	0.07	2.31	none
106	2.31	0	0.00	0.1861	0.10	0.10	2.41	none
107	2.41	0	0.00	0.1604	0.09	0.09	2.50	none
108	2.50	0	0.00	0.1539	0.09	0.09	2.60	none
109	2.60	0	0.00	0.1567	0.10	0.10	2.70	none
110	2.70	0	0.00	0.1925	0.12	0.12	2.81	none
111	2.81	0	0.00	0.2051	0.12	0.12	2.94	none
112	2.94	0	0.00	0.2067	0.12	0.12	3.06	none
113	3.06	0	0.00	0.1657	0.10	0.10	3.16	none
114	3.16	0.08	0.08	0.1610	0.10	0.02	3.18	none
115	3.18	0.22	0.22	0.1110	0.07	-0.15	3.02	none
116	3.02	0	0.00	0.1516	0.09	0.09	3.11	none
117	3.11	0	0.00	0.1604	0.09	0.09	3.20	none
118	3.20	0	0.00	0.1650	0.10	0.10	3.30	none
119	3.30	0	0.00	0.1758	0.11	0.11	3.41	none
120	3.41	0	0.00	0.1677	0.10	0.10	3.51	none
121	3.51	0.24	0.24	0.1476	0.09	-0.15	3.36	none
122	3.36	0	0.00	0.1409	0.08	0.08	3.44	none
123	3.44	0.27	0.27	0.1102	0.07	-0.20	3.24	none
124	3.24	0	0.00	0.1571	0.09	0.09	3.33	none
125	3.33	0	0.00	0.1780	0.11	0.11	3.44	none
126	3.44	0	0.00	0.1831	0.11	0.11	3.55	none
127	3.55	0.31	0.31	0.1760	0.11	-0.20	3.35	none
128	3.35	0.19	0.19	0.1390	0.08	-0.11	3.24	none
129	3.24	0.08	0.08	0.1551	0.09	0.01	3.25	none
130	3.25	0.01	0.01	0.1559	0.09	0.08	3.34	none
131	3.34	0	0.00	0.1311	0.08	0.08	3.41	none
132	3.41	0	0.00	0.1555	0.09	0.09	3.51	none
133	3.51	0.06	0.06	0.0976	0.06	0.00	3.51	none
134	3.51	0	0.00	0.1303	0.08	0.08	3.58	none
135	3.58	0.1	0.10	0.1453	0.09	-0.01	3.57	none
136	3.57	0.4	0.40	0.1343	0.08	-0.32	3.25	none
137	3.25	0.01	0.01	0.1452	0.08	0.07	3.32	none
138	3.32	0.02	0.02	0.1720	0.10	0.08	3.41	none
139	3.41	0	0.00	0.1335	0.08	0.08	3.49	none
140	3.49	0	0.00	0.1638	0.10	0.10	3.59	none
141	3.59	0	0.00	0.1953	0.12	0.12	3.70	none
142	3.70	0	0.00	0.2114	0.13	0.13	3.83	none
143	3.83	0	0.00	0.2336	0.13	0.13	3.96	none
144	3.96	0.21	0.21	0.2303	0.14	-0.07	3.89	none
145	3.89	0	0.00	0.1720	0.10	0.10	4.00	none
146	4.00	0	0.00	0.1256	0.08	0.08	4.07	none
147	4.07	0	0.00	0.1193	0.07	0.07	4.14	none
148	4.14	0	0.00	0.1713	0.10	0.10	4.25	none
149	4.25	0	0.00	0.1866	0.11	0.11	4.36	none
150	4.36	0	0.00	0.1941	0.12	0.12	4.37	none
151	4.37	0	0.00	0.1896	0.11	0.11	4.37	none
152	4.37	0	0.00	0.1980	0.12	0.12	4.37	none
153	4.37	0	0.00	0.1795	0.11	0.11	4.37	none
154	4.37	0	0.00	0.1858	0.11	0.11	4.37	none
155	4.37	0	0.00	0.2055	0.12	0.12	4.37	none
156	4.37	0	0.00	0.2146	0.13	0.13	4.37	none
157	4.37	0	0.00	0.2350	0.14	0.14	4.37	none
158	4.37	0	0.00	0.2266	0.14	0.14	4.37	none
159	4.37	0	0.00	0.2138	0.13	0.13	4.37	none
160	4.37	0	0.00	0.2193	0.13	0.13	4.37	none
161	4.37	0	0.00	0.2433	0.15	0.15	4.37	none
162	4.37	0	0.00	0.2508	0.15	0.15	4.37	none
163	4.37	0	0.00	0.2622	0.16	0.16	4.37	none
164	4.37	0	0.00	0.2740	0.16	0.16	4.37	none
165	4.37	0	0.00	0.2458	0.15	0.15	4.37	none
166	4.37	0	0.00	0.2543	0.15	0.15	4.37	none
167	4.37	0	0.00	0.2189	0.13	0.13	4.37	none
168	4.37	0	0.00	0.2193	0.13	0.13	4.37	none

169	4.37	0	0.00	0.2461	0.15	0.15	4.37	none
170	4.37	0	0.00	0.2526	0.15	0.15	4.37	none
171	4.37	0	0.00	0.2634	0.16	0.16	4.37	none
172	4.37	0	0.00	0.2358	0.14	0.14	4.37	none
173	4.37	0	0.00	0.2736	0.16	0.16	4.37	none
174	4.37	0	0.00	0.2535	0.15	0.15	4.37	none
175	4.37	0	0.00	0.2732	0.16	0.16	4.37	none
176	4.37	0	0.00	0.2326	0.16	0.16	4.37	none
177	4.37	0	0.00	0.2693	0.16	0.16	4.37	none
178	4.37	0	0.00	0.2799	0.17	0.17	4.37	none
179	4.37	0	0.00	0.2870	0.17	0.17	4.37	none
180	4.37	0	0.00	0.2508	0.15	0.15	4.37	none
181	4.37	0	0.00	0.2758	0.17	0.17	4.37	none
182	4.37	0.02	0.02	0.2577	0.16	0.14	4.37	none
183	4.37	0.08	0.08	0.2634	0.16	0.08	4.37	none
184	4.37	0.08	0.08	0.2087	0.13	0.05	4.37	none
185	4.37	0	0.00	0.2173	0.13	0.13	4.37	none
186	4.37	0	0.00	0.2409	0.14	0.14	4.37	none
187	4.37	0	0.00	0.2642	0.16	0.16	4.37	none
188	4.37	0	0.00	0.2803	0.17	0.17	4.37	none
189	4.37	0	0.00	0.2630	0.16	0.16	4.37	none
190	4.37	0.02	0.02	0.2063	0.12	0.10	4.37	none
191	4.37	0.19	0.19	0.2268	0.14	-0.05	4.31	none
192	4.31	0	0.00	0.2461	0.15	0.15	4.37	none
193	4.37	0.01	0.01	0.2374	0.14	0.13	4.37	none
194	4.37	0	0.00	0.2646	0.16	0.16	4.37	none
195	4.37	0	0.00	0.2496	0.15	0.15	4.37	none
196	4.37	0.05	0.05	0.2469	0.15	0.10	4.37	none
197	4.37	0	0.00	0.2453	0.15	0.15	4.37	none
198	4.37	0	0.00	0.2634	0.16	0.16	4.37	none
199	4.37	0	0.00	0.2539	0.15	0.15	4.37	none
200	4.37	0	0.00	0.2776	0.17	0.17	4.37	none
201	4.37	0	0.00	0.2921	0.18	0.18	4.37	none
202	4.37	0	0.00	0.2587	0.16	0.16	4.37	none
203	4.37	0	0.00	0.2654	0.16	0.16	4.37	none
204	4.37	0	0.00	0.2575	0.15	0.15	4.37	none
205	4.37	0	0.00	0.2591	0.16	0.16	4.37	none
206	4.37	0.03	0.03	0.2461	0.15	0.12	4.37	none
207	4.37	0	0.00	0.2756	0.17	0.17	4.37	none
208	4.37	0	0.00	0.2591	0.16	0.16	4.37	none
209	4.37	0	0.00	0.2669	0.16	0.16	4.37	none
210	4.37	0	0.00	0.2642	0.16	0.16	4.37	none
211	4.37	0	0.00	0.2685	0.16	0.16	4.37	none
212	4.37	0.09	0.09	0.2142	0.13	0.04	4.37	none
213	4.37	0	0.00	0.2402	0.14	0.14	4.37	none
214	4.37	0	0.00	0.2339	0.14	0.14	4.37	none
215	4.37	0.22	0.22	0.2673	0.16	-0.06	4.31	none
216	4.31	0	0.00	0.2409	0.14	0.14	4.37	none
217	4.37	0	0.00	0.2539	0.15	0.15	4.37	none
218	4.37	0	0.00	0.2374	0.14	0.14	4.37	none
219	4.37	0	0.00	0.2524	0.15	0.15	4.37	none
220	4.37	0	0.00	0.2492	0.15	0.15	4.37	none
221	4.37	0	0.00	0.2510	0.16	0.16	4.37	none
222	4.37	0	0.00	0.2531	0.15	0.15	4.37	none
223	4.37	0	0.00	0.2354	0.14	0.14	4.37	none
224	4.37	0	0.00	0.2417	0.15	0.15	4.37	none
225	4.37	0	0.00	0.2461	0.15	0.15	4.37	none
226	4.37	0	0.00	0.2520	0.15	0.15	4.37	none
227	4.37	0	0.00	0.2205	0.13	0.13	4.37	none
228	4.37	0.18	0.18	0.2205	0.13	-0.05	4.32	none
229	4.32	0	0.00	0.2114	0.13	0.13	4.37	none
230	4.37	0	0.00	0.2020	0.12	0.12	4.37	none
231	4.37	0	0.00	0.2106	0.13	0.13	4.37	none
232	4.37	0	0.00	0.2028	0.12	0.12	4.37	none
233	4.37	0	0.00	0.1791	0.11	0.11	4.37	none
234	4.37	0	0.00	0.2007	0.12	0.12	4.37	none
235	4.37	0	0.00	0.2110	0.13	0.13	4.37	none
236	4.37	0	0.00	0.2094	0.13	0.13	4.37	none
237	4.37	0.29	0.29	0.1941	0.12	-0.17	4.19	none
238	4.19	0.01	0.01	0.1445	0.09	0.08	4.27	none
239	4.27	0.08	0.08	0.1815	0.11	0.03	4.30	none
240	4.30	0	0.00	0.1776	0.11	0.11	4.37	none
241	4.37	0	0.00	0.2043	0.12	0.12	4.37	none
242	4.37	0	0.00	0.2094	0.13	0.13	4.37	none
243	4.37	0	0.00	0.1815	0.11	0.11	4.37	none
244	4.37	0	0.00	0.1791	0.11	0.11	4.37	none
245	4.37	0	0.00	0.1559	0.09	0.09	4.37	none
246	4.37	0	0.00	0.1854	0.11	0.11	4.37	none
247	4.37	0	0.00	0.2004	0.12	0.12	4.37	none
248	4.37	0	0.00	0.1991	0.12	0.12	4.37	none
249	4.37	0	0.00	0.2035	0.12	0.12	4.37	none
250	4.37	0	0.00	0.1961	0.12	0.12	4.37	none
251	4.37	0.41	0.41	0.1079	0.06	-0.35	4.02	none
252	4.02	0.33	0.33	0.1185	0.07	-0.26	3.76	none
253	3.76	0.26	0.26	0.1197	0.07	-0.19	3.58	none
254	3.58	1.19	1.19	0.0921	0.06	-1.13	2.44	none
255	2.44	0.18	0.18	0.1035	0.06	-0.12	2.32	none
256	2.32	0	0.00	0.1335	0.08	0.08	2.40	none
257	2.40	0.02	0.02	0.1398	0.08	0.06	2.47	none
258	2.47	0	0.00	0.1394	0.08	0.08	2.55	none
259	2.55	0	0.00	0.1555	0.09	0.09	2.64	none
260	2.64	0	0.00	0.1657	0.10	0.10	2.74	none
261	2.74	0	0.00	0.1547	0.09	0.09	2.84	none
262	2.84	0	0.00	0.1642	0.10	0.10	2.93	none
263	2.93	0	0.00	0.1654	0.10	0.10	3.03	none
264	3.03	0	0.00	0.1701	0.10	0.10	3.14	none
265	3.14	0	0.00	0.1390	0.08	0.08	3.22	none
266	3.22	0	0.00	0.1319	0.08	0.08	3.30	none
267	3.30	0	0.00	0.1236	0.07	0.07	3.37	none
268	3.37	0	0.00	0.1455	0.09	0.09	3.46	none
269	3.46	0	0.00	0.1480	0.09	0.09	3.55	none
270	3.55	0	0.00	0.1311	0.08	0.08	3.63	none

271	3.63	0	0.00	0.1433	0 09	0.09	3.71	none
272	3.71	0	0.00	0.1524	0 09	0.09	3.81	none
273	3.81	0	0.00	0.1535	0.09	0.09	3.90	none
274	3.90	0	0.00	0.1496	0.09	0.09	3.99	none
275	3.99	0	0.00	0.1618	0.10	0.10	4.08	none
276	4.08	0	0.00	0.1581	0.10	0.10	4.18	none
277	4.18	0	0.00	0.1421	0.09	0.09	4.27	none
278	4.27	0	0.00	0.1437	0 09	0.09	4.35	none
279	4.35	0	0.00	0.1472	0.09	0.09	4.37	none
280	4.37	0	0.00	0.1319	0 08	0.08	4.37	none
281	4.37	0	0.00	0.1352	0.08	0.08	4.37	none
282	4.37	0	0.00	0.1461	0.09	0.09	4.37	none
283	4.37	0	0.00	0.1516	0.09	0.09	4.37	none
284	4.37	0	0.00	0.1362	0 08	0.08	4.37	none
285	4.37	0	0.00	0.1391	0.08	0.08	4.37	none
286	4.37	0	0.00	0.1280	0.08	0.08	4.37	none
287	4.37	0.23	0 23	0.0701	0.04	-0.19	4.18	none
288	4.18	0.08	0.08	0.0972	0.06	-0.02	4.16	none
289	4.16	0.33	0.33	0.0917	0.06	-0.27	3.88	none
290	3.88	0.03	0.03	0.0480	0.03	0.00	3.88	none
291	3.88	0	0.00	0.0579	0.03	0.03	3 92	none
292	3.92	0	0.00	0.0626	0.04	0.04	3.95	none
293	3.95	0	0.00	0.0726	0.04	0.04	4.00	none
294	4.00	0	0.00	0.0776	0 05	0.05	4 04	none
295	4.04	0	0.00	0.0823	0 05	0.05	4.09	none
296	4.09	0	0.00	0.0835	0.05	0.05	4.14	none
297	4.14	0	0.00	0.0819	0 05	0.05	4.19	none
298	4.19	0	0 00	0.0664	0 04	0.04	4.23	none
299	4.23	0	0.00	0.0661	0 04	0.04	4.27	none
300	4.27	0	0.00	0.0673	0.04	0.04	4.31	none
301	4.31	0.12	0.12	0.0406	0.02	-0.10	4.21	none
302	4.21	0	0.00	0.0524	0.03	0.03	4.24	none
303	4.24	0	0.00	0.0553	0.03	0.03	4 28	none
304	4.28	0	0.00	0.0630	0.04	0.04	4.32	none
305	4.32	0	0 00	0.0697	0.04	0.04	4.36	none
306	4.36	0	0.00	0.0685	0.04	0.04	4.37	none
307	4.37	0	0.00	0.0713	0.04	0.04	4.37	none
308	4.37	0	0.00	0.0736	0.04	0.04	4.37	none
309	4.37	0	0.00	0.0710	0.04	0.04	4.37	none
310	4.37	0	0.00	0.0858	0.05	0.05	4.37	none
311	4.37	0	0.00	0.0803	0.05	0.05	4.37	none
312	4.37	0	0.00	0.0799	0.05	0.05	4.37	none
313	4.37	0	0.00	0.0815	0.05	0.05	4.37	none
314	4.37	0	0.00	0.0791	0 05	0.05	4.37	none
315	4.37	0	0.00	0.0720	0.04	0.04	4.37	none
316	4.37	0	0.00	0.0713	0.04	0.04	4.37	none
317	4.37	0	0.00	0.0551	0.03	0.03	4.37	none
318	4.37	0.06	0.06	0.0551	0.03	-0.03	4.34	none
319	4.34	0	0.00	0.0425	0.03	0.03	4.37	none
320	4.37	0	0.00	0.0350	0.02	0.02	4.37	none
321	4.37	0	0.00	0.0350	0.02	0.02	4.37	none
322	4.37	0	0.00	0.0311	0.02	0.02	4.37	none
323	4.37	0	0.00	0.0370	0.02	0.02	4.37	none
324	4.37	0	0.00	0.0406	0 02	0.02	4.37	none
325	4.37	0	0.00	0.0433	0.03	0.03	4.37	none
326	4.37	0	0.00	0.0484	0.03	0.03	4.37	none
327	4.37	0	0.00	0.0413	0.02	0.02	4 37	none
328	4.37	0	0.00	0.0421	0.03	0.03	4.37	none
329	4.37	0.24	0.24	0.0370	0.02	-0.22	4.15	none
330	4.15	0	0.00	0.0378	0.02	0.02	4.17	none
331	4.17	0	0.00	0.0393	0.02	0.02	4.19	none
332	4.19	0	0.00	0.0374	0 02	0.02	4 21	none
333	4.21	0	0.00	0.0358	0.02	0.02	4.24	none
334	4.24	0	0.00	0.0384	0.02	0.02	4 26	none
335	4.26	0	0.00	0.0372	0 02	0.02	4.27	none
336	4.27	0	0.00	0.0386	0.02	0.02	4.30	none
337	4.30	0	0.00	0.0413	0.02	0.02	4.32	none
338	4.32	0	0.00	0.0382	0.02	0.02	4.35	none
339	4.35	0	0 00	0.0425	0.03	0.03	4 37	none
340	4.37	0.02	0.02	0 0370	0.02	0.00	4.37	none
341	4.37	0	0.00	0 0445	0.03	0.03	4 37	none
342	4.37	0	0.00	0 0354	0 02	0.02	4.37	none
343	4.37	0	0 00	0 0307	0.02	0.02	4.37	none
344	4.37	0	0.00	0 0395	0 02	0.02	4.37	none
345	4.37	0	0.00	0 0315	0.02	0.02	4.37	none
346	4.37	0	0.00	0 0327	0 02	0.02	4.37	none
347	4.37	0	0.00	0 0374	0.02	0.02	4 37	none
348	4.37	0	0 00	0 0409	0 02	0.02	4 37	none
349	4.37	0	0.00	0 0457	0.03	0.03	4.37	none
350	4.37	0	0.00	0 0386	0.02	0.02	4.37	none
351	4.37	0	0.00	0 0524	0.03	0.03	4.37	none
352	4.37	0	0.00	0.0496	0.03	0.03	4.37	none
353	4.37	0	0.00	0.0445	0.03	0.03	4.37	none
354	4.37	0	0.00	0 0406	0.02	0.02	4.37	none
355	4.37	0	0.00	0 0445	0 03	0.03	4.37	none
356	4.37	0	0 00	0.0406	0.02	0.02	4.37	none
357	4.37	0	0.00	0 0402	0.02	0.02	4.37	none
358	4.37	0	0.00	0 0402	0.02	0.02	4.37	none
359	4.37	0	0.00	0 0433	0 03	0.03	4.37	none
360	4.37	0	0 00	0 0388	0.02	0.02	4.37	none
361	4.37	0	0.00	0 0433	0 03	0 03	4.37	none
362	4.37	0	0.00	0.0488	0 03	0.03	4.37	none
363	4.37	0	0.00	0 0425	0 03	0.03	4.37	none
364	4.37	0	0.00	0.0503	0.03	0.03	4.37	none
365	4.37	0	0.00	0 0492	0 03	0.03	4.37	none
366	4.37	0	0.00	0.0453	0 03	0.03	4.37	none

APPENDIX J

EMERY COUNTY RESOLUTION NO. 10-5-94C

A RESOLUTION TO ESTABLISH A FINANCIAL ASSURANCE TRUST FUND FOR CLOSURE OF EMERY COUNTY LANDFILL

WHEREAS, the Emery County Landfill is required by its licensing body to establish a Financial Assurance Fund in the event of closure of the landfill; and,

WHEREAS, the Board of Commissioners has determined that it is appropriate to establish an expendable Trust Fund in the amount of $133,000.00; and,

WHEREAS, a $133,000.00 expendable Trust Fund is sufficient to fulfill the required financial assurance;

NOW, THEREFORE, the Board of County Commissioners of the County of Emery hereby resolves:

To establish a Financial Assurance Trust Fund in Emery County in accordance with Section 17-36-6(1)(m), Utah Code Annotated (1953), as amended. Said Fund shall be established in the amount of $133,000.00, unless the Landfill's licensing agency determines on an annual basis that a greater amount is necessary, at which time the Fund may be increased by resolution. Interest earned on said funds shall be payable to the Emery County General Fund.

ADOPTED by the Board of County Commissioners of Emery County, State of Utah, this 5th day of October, 1994.

LANDFILL CLOSURE COSTS

Section 1.0 - Engineering

North Mass Fill Area

DATE TO BE CLOSED = Winter 2008

AREA TO BE CLOSED = 265,000 SQ FT

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	Topographic Survey	LS	$85	16	$1,360
1.2	Boundary Survey for Closure	NA	$85	8	$680
1.3	Site Evaluation	NA	$85	8	$680
1.4	Development of Plans (Cover)	LS	$75	80	$6,000
1.5	Contract Administration - (Bidding and Award)	LA	$85	32	$2,720
1.6	Administrative Costs - (Certification of Final Cover and Closure Notice)	LS	$85	8	$680
1.7	Project Management - (Construction Observation and Testing)	LS	$45	80	$3,600
1.8	Monitor Well Consultant Cost	NA			$0
1.9	Other Environmental Permit Costs	NA			$0
				Engineering Subtotal	$15,720

Section 2.0 - Construction

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Final Cover System**				
2.1.1	*Site Preparation/ Site Regrading*	ACRE	$1,000	6.1	$6,084
2.1.2	*Gas Collection Layer/Pipes*	Included below			$0
2.1.3	*Low permeability Layer (Included in Erosion Protection Layer)*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	NA			$0
c	Soil Transportation	NA			$0
d	Soil Placement	NA			$0
e	Soil Amendment (compact)	NA			$0
2.1.4	*Low permeability Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	GCL	NA			$0
c	Geomembrane (HDPE,PVC,LLDPE,etc...)	NA			$0
2.1.5	*Drainage Layer (Soil - If Applicable)*				
a	Geotextile	NA			$0
b	Sand/Gravel	NA			$0
2.1.6	*Drainage Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	Geonet/Geocomposite	NA			$0
2.1.7	*Erosion Protection Soil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$0.50	19,630	$9,815
c	Soil Transportation	CY	$1.00	19,630	$19,630
d	Soil Placement	CY	$0.75	19,630	$14,722
e	Soil Amendment (compact)	CY	$0.50	19,630	$9,815
2.1.8	*Topsoil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$0.50	4,907	$2,454
c	Soil Transportation	CY	$1.00	4,907	$4,907
d	Soil Placement	CY	$0.75	4,907	$3,681
e	Soil Amendment	NA			$0
2.1.9	*Revegetation*				
a	Seeding	ACRE	$800	6.1	$4,867
b	Fertilizing	ACRE	$800	6.1	$4,867
c	Mulch	ACRE	$200	6.1	$1,217
d	Tacifier	ACRE	$200	6.1	$1,217
2.2	**Stormwater Protection Structures**				
a	Culverts	NA			$0
b	Pipes	NA			$0
c	Ditches/Berms	NA			$0
d	Detention Basins	NA			$0
2.3	**Gas Collection System**				
a	Design	NA			$0
b	Additional Gas Collection Wells and Connection	NA			$0
c	THOX Unit - (Optional)	NA			$0
2.4	**Leachate Collection System**				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.5	**Groundwater Monitoring System**				
a	Monitor Well Installation	NA			$0
b	Monitor Well Abandonment	NA			$0
2.6	**Site Security**				
a	Lighting, signs, etc...	NA			$0
b	Fencing and Gates	NA			$0
2.7	**Miscellaneous**				
a	Performance Bonds	LS	$3,000	1	$3,000
b	Contract/Legal fees	LS	$3,000	1	$3,000
2.8	**Other Site Waste Areas**				
a	Dead Animal Area	ALL	$5,000	1	$5,000
b	Asbestos Cell	ALL	$5,000	1	$5,000
c	Misc. Site Waste Areas	ALL	$5,000	1	$5,000
				Construction Subtotal	$104,274

LS - LUMP SUM
NA - NOT APPLICABLE
EA - EACH
CY - CUBIC YARD
FT - FEET
ALL - ALLOWANCE

Total	$119,994
10% Contingency	$11,999
Subtotal Closure Cost	$131,993

LANDFILL CLOSURE COSTS

Section 1.0 - Engineering

Southeast Excavated Area

DATE TO BE CLOSED = Summer 2012

AREA TO BE CLOSED = 165,000 SQ FT

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	**Topographic Survey**	LS	$85	16	$1,360
1.2	**Boundary Survey for Closure**	NA	$85	8	$680
1.3	**Site Evaluation**	NA	$85	8	$680
1.4	**Development of Plans** (Cover and Gas Collection)	LS	$75	80	$6,000
1.5	**Contract Administration** - (Bidding and Award)	LA	$85	32	$2,720
1.6	**Administrative Costs** - (Certification of Final Cover and Closure Notice)	LS	$85	8	$680
1.7	**Project Management** - (Construction Observation and Testing)	LS	$45	80	$3,600
1.8	**Monitor Well Consultant Cost**	NA			$0
1.9	**Other Environmental Permit Costs**	NA			$0
				Engineering Subtotal	$15,720

Section 2.0 - Construction

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Final Cover System**				
2.1.1	*Site Preparation/ Site Regrading*	ACRE	$1,000	3.8	$3,788
2.1.2	*Gas Collection Layer/Pipes*	Included below			$0
2.1.3	*Low permeability Layer (Included in Erosion Protection Layer)*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	NA			$0
c	Soil Transportation	NA			$0
d	Soil Placement	NA			$0
e	Soil Amendment (compact)	NA			$0
2.1.4	*Low permeability Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	GCL	NA			$0
c	Geomembrane (HDPE,PVC,LLDPE,etc...)	NA			$0
2.1.5	*Drainage Layer (Soil - If Applicable)*				
a	Geotextile	NA			$0
b	Sand/Gravel	NA			$0
2.1.6	*Drainage Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	Geonet/Geocomposite	NA			$0
2.1.7	*Erosion Protection Soil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$0.50	12,222	$6,111
c	Soil Transportation	CY	$1.00	12,222	$12,222
d	Soil Placement	CY	$0.75	12,222	$9,167
e	Soil Amendment (compact)	CY	$0.50	12,222	$6,111
2.1.8	*Topsoil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$0.50	3,056	$1,528
c	Soil Transportation	CY	$1.00	3,056	$3,056
d	Soil Placement	CY	$0.75	3,056	$2,292
e	Soil Amendment	NA			$0
2.1.9	*Revegetation*				
a	Seeding	ACRE	$800	3.8	$3,030
b	Fertilizing	ACRE	$800	3.8	$3,030
c	Mulch	ACRE	$200	3.8	$758
d	Tacifier	ACRE	$200	3.8	$758
2.2	**Stormwater Protection Structures**				
a	Culverts	NA			$0
b	Pipes	NA			$0
c	Ditches/Berms	NA			$0
d	Detention Basins	NA			$0
2.3	**Gas Collection System**				
a	Design	NA			$0
b	Additional Gas Collection Wells and Connection	NA			$0
2.4	**Leachate Collection System**				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.5	**Groundwater Monitoring System**				
a	Monitor Well Installation	NA			$0
b	Monitor Well Abandonment	NA			$0
2.6	**Site Security**				
a	Lighting, signs, etc...	NA			$0
b	Fencing and Gates	NA			$0
2.7	**Miscellaneous**				
a	Performance Bonds	LS	$3,000	1	$3,000
b	Contract/Legal fees	LS	$3,000	1	$3,000
2.8	**Other Site Waste Areas**				
a	Dead Animal Area	ALL	$5,000	1	$5,000
b	Asbestos Cell	ALL	$5,000	1	$5,000
c	Misc. Site Waste Areas	ALL	$5,000	1	$5,000
				Construction Subtotal	$72,850

LS - LUMP SUM
NA - NOT APPLICABLE
EA - EACH
CY - CUBIC YARD
FT - FEET
ALL - ALLOWANCE

Total	$88,570
10% Contingency	$8,857
Subtotal Closure Cost	$97,427

LANDFILL CLOSURE COSTS

Section 1.0 - Engineering

Southeast Mass Fill Area

DATE TO BE CLOSED = Spring 2020

AREA TO BE CLOSED = 165,000 SQ FT

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	**Topographic Survey**	LS	$85	16	$1,360
1.2	**Boundary Survey for Closure**	NA	$85	8	$680
1.3	**Site Evaluation**	NA	$85	8	$680
1.4	**Development of Plans** (Cover and Gas Collection)	LS	$75	80	$6,000
1.5	**Contract Administration** - (Bidding and Award)	LA	$85	32	$2,720
1.6	**Administrative Costs** - (Certification of Final Cover and Closure Notice)	LS	$85	8	$680
1.7	**Project Management** - (Construction Observation and Testing)	LS	$45	80	$3,600
1.8	**Monitor Well Consultant Cost**	NA			$0
1.9	**Other Environmental Permit Costs**	NA			$0
				Engineering Subtotal	$15,720

Section 2.0 - Construction

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Final Cover System**				
2.1.1	*Site Preparation/ Site Regrading*	ACRE	$1,000	3.8	$3,788
2.1.2	*Gas Collection Layer/Pipes*	NA			$0
2.1.3	*Low permeability Layer (Included in Erosion Protection Layer)*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	NA			$0
c	Soil Transportation	NA			$0
d	Soil Placement	NA			$0
e	Soil Amendment (compact)	NA			$0
2.1.4	*Low permeability Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	GCL	NA			$0
c	Geomembrane (HDPE,PVC,LLDPE,etc...)	NA			$0
2.1.5	*Drainage Layer (Soil - If Applicable)*				
a	Geotextile	NA			$0
b	Sand/Gravel	NA			$0
2.1.6	*Drainage Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	Geonet/Geocomposite	NA			$0
2.1.7	*Erosion Protection Soil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$0.50	12,222	$6,111
c	Soil Transportation	CY	$1.00	12,222	$12,222
d	Soil Placement	CY	$0.75	12,222	$9,167
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2.1.8	*Topsoil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$0.50	3,056	$1,528
c	Soil Transportation	CY	$1.00	3,056	$3,056
d	Soil Placement	CY	$0.75	3,056	$2,292
e	Soil Amendment	NA			$0
2.1.9	*Revegetation*				
a	Seeding	ACRE	$800	3.8	$3,030
b	Fertilizing	ACRE	$800	3.8	$3,030
c	Mulch	ACRE	$200	3.8	$758
d	Tacifier	ACRE	$200	3.8	$758
2.2	**Stormwater Protection Structures**				
a	Culverts	NA			$0
b	Pipes	NA			$0
c	Ditches/Berms	NA			$0
d	Detention Basins	NA			$0
2.3	**Gas Collection System**				
a	Design	NA			$0
b	Additional Gas Collection Wells and Connection	NA			$0
2.4	**Leachate Collection System**				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.5	**Groundwater Monitoring System**				
a	Monitor Well Installation	NA			$0
b	Monitor Well Abandonment	NA			$0
2.6	**Site Security**				
a	Lighting, signs, etc...	NA			$0
b	Fencing and Gates	NA			$0
2.7	**Miscellaneous**				
a	Performance Bonds	LS	$3,000	1	$3,000
b	Contract/Legal fees	LS	$3,000	1	$3,000
2.8	**Other Site Waste Areas**				
a	Dead Animal Area	ALL	$5,000	1	$5,000
b	Asbestos Cell	ALL	$5,000	1	$5,000
c	Misc. Site Waste Areas	ALL	$5,000	1	$5,000
				Construction Subtotal	$72,850

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NA - NOT APPLICABLE
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Total	$88,570
10% Contingency	$8,857
Subtotal Closure Cost	$97,427

LANDFILL POST-CLOSURE COSTS (30 YEARS)

Section 1.0 - Engineering

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	**Post-Closure Plan**	NA			$0
1.2	**Annual Report** (including results from gas, leachate, and ground water sampling - details of maintenance performed)	EA	$500	30	$15,000
a	Semiannual Site Inspections	EA	$80	60	$4,800
b	Plan Update	EA	$100	30	$3,000
				Engineering Subtotal	$22,800

Section 2.0 - Gas Collection System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Sample Collection**	NA			$0
2.2	**Sample Analysis**	NA			$0
2.3	**Report** (Part of Annual Report)	NA			
				Gas Collection System - Sampling Subtotal	$0

Section 3.0 - Leachate Collection System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Sample Collection**	NA			$0
2.2	**Sample Analysis**	NA			$0
2.3	**Report** (Part of Annual Report)				
				Leachate Collection System - Sampling Subtotal	$0

Section 4.0 - Ground Water Monitoring System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
3.1	**Sample Collection**	NA			$0
3.2	**Sample Analysis**	NA			$0
3.3	**Report** (Part of Annual Report)				
				Ground Water Collection System - Sampling Subtotal	$0

Section 5.0 - Facility Operations and Maintenance

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
4.1	**Cover**				
a	Soil Replacement	LS	$500	30	$15,000
b	Vegetation/Reseeding	LS	$300	30	$9,000
4.2	**Storm Water Protection Structures**				
a	Ditch and Culvert Maintenance	LS	$200	30	$6,000
b	Berm and Basin Maintenance	LS	$200	30	$6,000
4.3	**Gas Collection System**				
a	System Operation	NA			$0
b	System Repair	NA			$0
4.4	**Leachate Collection System**				
a	System Operation	NA			$0
b	System Repair	NA			$0
4.5	**Ground Water Monitoring System**				
a	System Operation	NA			$0
b	System Repair	NA			$0
4.6	**Site Security**				
a	Lighting, signs, etc...	LS	$250	30	$7,500
b	Fencing and Gates	LS	$250	30	$7,500
4.7	**Miscellaneous**				
a	Animal pit, asbestos cell, etc...	LS	$200	30	$6,000
b					
				Facility Operations and Maintenance Subtotal	$57,000

Total	$79,800
10% Contingency	$7,980
Total Post-Closure Cost	$87,780

APPENDIX K

DRAINAGE STUDY

EMERY COUNTY LANDFILL

EMERY COUNTY, UTAH

Prepared By:

LAMOREAUX ASSOCIATES
Engineers and Planners
(An associate of Creative Technology)
444 South Main Street, Cedar City, UT 84720
phone(801)586-0174 fax/modem(801)865-1848

REGISTERED PROFESSIONAL ENGINEER
No. 8607
STATE OF UTAH

TABLE OF CONTENTS

EMERY COUNTY LANDFILL, CELLS A & B
DRAINAGE STUDY

1.0 INTRODUCTION

This drainage study has been prepared on behalf of Tahoma Companies, for the Emery County Landfill, in Emery County, Utah. This landfill is located 2 miles north of Orangeville, Utah, in the NW 1/4 of Section 16, Township 18 South, Range 8 East, S.L.B.&M.

2.0 PURPOSE

The purpose of this study is to estimate the probable 25-year maximum storm run-off from natural drainages leading to the Emery County Landfill, cells A & B, and size flood control improvements to divert flood waters around the Landfill, and culvert sizes for road crossings near the landfill.

3.0 STUDY AREA

The study area is a small area to the northwest of the landfill. The total area of the study is 0.18 square miles. This study area was then broken down into four (4) smaller areas. These four areas are used in determining the size of flood control improvements.

A detailed drawing showing the study area, and drawing with areas is attached as appendix A. The drawings include:

- Drainage Areas designated 1 and 2.
- Landfill cells A & B.

4.0 METHOD USED TO DETERMINE RUN-OFF/SOURCE OF DATA

The method used to evaluate the run-off is the Utah Department of Transportation "Small Area Method", from the UDOT Manual of Instruction, Part 4 revised 1984. This method is utilized for areas below 5 square miles.

8.0 CONCLUSIONS

The flooding potential for the Emery County Landfill is low. It is recommended that a ditch be installed on the perimeter of the landfill, diverting run-off to the natural channel south of cells A & B. Culverts to cross this ditch, and the natural channel to the south will be required, with sizes as indicated above.

EMERY COUNTY LANDFILL DRAINAGE STUDY

FOR SMALL FLOWS OUTSIDE THE CELLS. AND FOR CELLS
FLOWS BASED ON: UDOT SMALL AREA RUNOFF METHOD -
BY: B. LAMOREAUX
DATE: 7/19/94
REVISION: 0
ASSUMPTIONS:

I-10=		1.000
I-25=		1.200
I-100=		1.600
K FACTOR=		0.097
LAND FACTOR=		2.000
FF-10=		0.833
FF-25=		1.000
FF-100=		1.333
CULVERT PROJECTING - 2-48/NOMO 3		

SEGMENT	AREA SQ FT	AREA ACRES	QC	QF 10 YEAR	QF 25 YEAR	QF 100 YEAR
1	1,310,378	30.08	9.68	16.14	19.36	25.82
2	3,214,734	73.80	19.78	32.93	39.52	52.69
A	250,000	5.74	2.59	4.32	5.19	6.92
B	250,000	5.74	2.59	4.32	5.19	6.92

0.18 sq. mi.

DITCH ON NORTH AND WEST SIDES OF CELLS----------
FLOW FROM AREA 1 19.36 CFS
TRIANGULAR DITCH REQD AT 10 FT/S. ASSUME 10' WIDE 0.39 =DEPTH
USE 10'X1' TRIANGULAR DITCH

CULVERTS ON NORTH AND WEST SIDES OF CELLS----------
FLOW FROM AREA 1 19.36 CFS
MAX FLOW FROM 30" CULVERT 31.00 CFS
CULVERT SIZE/NUMBER 0.62 30" USE 1

CULVERT BELOW CELL A ACROSS DRAINAGE----------
FLOW FROM AREA 1 & 2 & CELLS 69.26 CFS
MAX FLOW FROM 42" CULVERT 65.00 CFS
CULVERT SIZE/NUMBER 1.07 42" USE 1-42"

MAXIMUM FLOWS POSSIBLE - CMP

SIZE		COVER	HEADWATER	HW DIAM.	CFS (NOMO)	FULL AT 10 FT/S CFS
12		12.28	24.28	2.02	2.9	7.9
18		12.28	30.28	1.68	8.0	17.7
24		12.28	36.28	1.51	15.0	31.4
30		12.28	42.28	1.41	31.0	49.1
36		12.28	48.28	1.34	46.0	70.7
42		12.28	54.28	1.29	65.0	96.2
48		12.28	60.28	1.26	88.0	125.6

johansen & tuttle ENGINEERING, INC.
BOX 487 • CASTLE DALE, UTAH 84513 • TELEPHONE (801) 381-2523

October 29, 1997

State of Utah
Department of Environmental Quality
Division of Solid and Hazardous Waste
P.O. Box 144880
Salt Lake City, Utah 84118-4880

Re: Emery County Landfill Permit Application #9427
Run-on and Run-off Control Plan

Attn: Jeff Emmons

Dear Mr. Emmons:

In response to your RAI #4 I have reviewed the report on the drainage study prepared by Lamoreaux Associates, in regards to the drainage being applicable to the New Landfill Design. The New Design will not alter the study area that was completed by Lamoreaux. Although the New Design has changed since the original proposal, the drainage area still remains the same. The recommended ditch locations and culvert sizes would remain the same and still be located as recommended.

If you have further questions please contact me.

Sincerely,

Howard R. Tuttle

C.C. Rex Runk, County Road
Bevan Wilson, County Commissioner